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STS-13 (41-C) BET PRODUCTS

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ABSTRACT

Results from the STS-13(41-C) Shuttle entry flight are presented. The entry trajectory was reconstructed from an altitude of 700 kft through rollout on Runway 17 at EAFB. The anchor epoch utilized was April 13, 1984 $13^{h}1^{m}30.^{s}0$ ($46890.^{s}0$) GMT. The final reconstructed inertial trajectory for this flight is BT13M23 under user catalog 169750N. Trajectory reconstruction and Extended BET development are discussed in Section I and II, respectively. The NOAA "totem-pole" atmosphere extracted from the JSC/TRW BET was adopted in the development of the LaRC Extended BET, namely ST13BET/UN=274885C. The Aerodynamic BET was generated on physical nine track reel NC0728 with a duplicate copy on NC0740 for back-up. Plots of the more relevant parameters from the AEROBET are presented in Section III. Flight events (times) and mission profile data are listed below for future reference:

	time (sec from epoch)	altitude (kft)
Entry interface	382	400
Initial flight extraction	510	320
Maximum Mach number encountered	621	266
Mach 25	874	242
Mach 20	1134	220
Mach 15	1313	194
Mach 10	1469	170
Mach 5	1678	123
Mach 2	1857	77
Mach 1	1954	51
Main gear deployment	2178	--
Weight on Wheels (WOW)	2196	--
Weight on Nose Gear (WONG)	2212	--
stop time	2246	--

Section IV discusses the MMLE input files created for STS-13. Appendices are attached which present spacecraft and physical constants utilized (Appendix A), residuals by station and data type (Appendix B), a two second spaced listing of trajectory and air data parameters (Appendix C), and input and output source products for archival (Appendix D).

I. Entry Trajectory Reconstruction

I.a. Dynamic data

IMU2 was selected as the dynamic data source for the STS-13 entry reconstruction. Figure I-1 shows the dynamic data time history over five hundred(500) second intervals starting at 0 seconds (~700 kft). Body axes rates and accelerations derived from the IMU2 measured ΔV_{M50} and quaternions are plotted.

In terms of the total sensed ΔV magnitude, the tri-redundant IMUs agreed very well. IMU1 and IMU2 agreed to within 0.52 fps while IMU3 was within 0.31 fps of the other two. Mid-value selection (percentage of occurrences) for the various units are shown in the following two tables:

Accelerometer Comparisons Based on 2233 Points

	Percentage mid-value measurement		
	IMU1	IMU2	IMU3
$\Delta V_{X_{M50}}$	1	56	43
$\Delta V_{Y_{M50}}$	9	27	64
$\Delta V_{Z_{M50}}$	1	72	27

Gyro Comparisons Based on 2238 Points

	Percentage mid-value measurement		
	IMU1	IMU2	IMU3
Euler ψ	28	31	41
Euler θ	18	39	43
Euler ϕ	45	16	39
Total angle, Γ	51	4	45
Total angular rate, $\dot{\Gamma}$	32	35	33

No clear choice is evidenced by these results. Arbitrarily, IMU2 was selected. One data gap of ~4 seconds was detected in the Operational Instrumentation (OI) recorded data which affected both the ΔVs and quaternions for all three(3) IMUs. This gap starts at ~1941 seconds from epoch.

I.b. Tracking data

Tracking coverage for STS-13 consisted of an S-band pass from Goldstone, eight(8) C-band radars, and five(5) cine-theodolite cameras in the vicinity of Runway 17 at Edwards. S-band data from Hawaii were also obtained via the GSFC, but these data were not utilized in the reconstruction process since there were no ranging measurements and only limited Doppler data above 5° elevation angle. Tracking coverages are depicted in Figures I-2 and I-3. Figure I-2 shows the entire ground track for STS-13 with stations (complexes) as noted. Times and corresponding altitudes at 500^{s} increments along the track are given. Figures I-3a, I-3b, and I-3c show the detailed tracking coverage from entry to California C-band acquisition, California C-band acquisition to final approach, and final approach to landing, respectively. Times, altitudes and station coverages with respect to the ground track are as shown. Acronyms and locations for the STS-13 trackers are given in Table I.

I.c. Reconstruction results

The final BET solution for STS-13, BT13M23, is presented in Table II. For comparison, the initial estimate from the onboard navigation system, the JSC/TRW estimate and a state-only ENTREE estimate are also given. The excellent agreement between the JSC/TRW and LaRC/AMA solutions at epoch prevails, in general, throughout the entry trajectory. Comparison of the two ENTREE estimates show that a significant improvement in the fit to the tracking data is achieved by expanding the solution set to include accelerometer scale factors. Although not to be interpreted as calibrations of IMU2, the accelerometer scale factor estimates given in Table II are in accord with the 1σ performance specification levels of 100 ppm along each axis. The weighted fit statistics for BT13M23, based on 6060 observations, are $\mu_w = -0.165$ and $\sigma_w = 1.193$. A summary of the residuals, by station and data type, is given in Table III. Plots of the final residuals are given as Appendix B. Composite residuals are included in this section. The symbol key for the stations appearing on the composite plots is given as Figure I-4. Composite range, azimuth and elevation residuals are shown as Figure I-5, I-6, and I-7, respectively.

Comparisons of the final BET position and velocity after rollout on Runway 17 versus post-landed survey values are given below:

END CONDITIONS AT VEHICLE STOP (Runway #17 Coordinates)

	Survey	BT13M23
X, ft	+10628	+10617
Y, ft	0	+1
$h-h_{RW}$, ft	+16	+15
$\dot{X}$, fps	0	+0.02
$\dot{Y}$, fps	0	-0.11
$\dot{h}$, fps	0	+0.03

Figure I-8 presents plots of the BET during rollout on Runway 17. Surveyed values are depicted thereon. Vehicle stop occurs 2246 seconds after epoch.

TYPE	STATION NO.	STATION NAME	LATITUDE (GEOD.) (DEG)	LONGITUDE (DEG)	ALT (ABOVE REF.) (FT)	MODULUS OF REFRACTION	SCALE HEIGHT (M)
C-BAND, TPQ-18	2	KMTC	8.71950	167.71837	91.5700	N/A	N/A
C-BAND, TPQ-18	3	VDBC	34.66587	239.41865	203.5433	324.	7098.
THEODOLITE	4	THE08	34.99710	242.15591	2139.1400	N/A	N/A
C-BAND, FPS-16	5	VDSC	34.58276	239.43853	1972.1457	307.	6737.
THEODOLITE	6	THE01	34.91673	242.29058	2742.4000	N/A	N/A
THEODOLITE	8	THE09	34.94739	242.08924	2370.2200	N/A	N/A
C-BAND, FPS-16	9	FRCC	34.96083	242.08856	2480.3478	290.	7745.
C-BAND, FPS-16	10	EAFC	34.96962	242.06974	2521.7192	290.	7726.
THEODOLITE	11	THE07	34.92839	242.23770	2378.5000	N/A	N/A
S-BAND, M-S	12	GDSS	35.34221	243.12654	2994.4600	281.	7885.
C-BAND, FPQ-14	14	KPTC	21.57210	201.73343	931.4000	N/A	N/A
C-BAND, FPS-16	15	SNFC	33.24771	240.47935	732.1500	320.	6951.
THEODOLITE	16	THE15	34.89239	241.99087	2696.6400	N/A	N/A
C-BAND, FPS-16	20	EFFC	34.97046	242.06858	2540.2200	290.	7717.

Table I. STS-13 station locations and refraction data.

EPOCH: 4/13/84 $13^h01^m30^s$ (46890^s) GMT

DATA TYPES: S-band, 1 radar (GDSS)
C-band, 8 radars (KMTC, KPTC, VDBC, VDSC, SNFC, FRCC, EAFC, EFFC)
Cine-theodolite, 5 cameras (THEO1, THEO7, THEO8, THEO9, THE15)

5° elevation angle constraint on C, S-band; No constraint on theodolite
NOTE: Hawaii S-band data not used because of sparse, low elevation coverage

Parameter	Initial Estimate, NAV		JSC/TRW	BT13M22[1]	Final Solution, BT13M23[2]
V_R, fps	24269.8		24269.3	24271.6	24269.024
γ_R, deg	-2.034		-2.036	-2.029	-2.0359283
Ψ_R, deg	59.723		59.723	59.724	59.723345
h_D, ft	698176		699510	696311	699611.72
Φ_D, deg	-1.283		-1.302	-1.303	-1.3012990
λ, deg	150.044		150.012	150.007	150.01312
ψ, deg	57.721	see	57.719	57.663	57.660047
θ, deg	35.156	Appendix	35.098	35.079	35.084154
ϕ, deg	-3.915	A	-3.932	-3.932	-3.9340641
μ_w	---		---	-0.848	-0.165
σ_w	---		---	4.147	1.193

(1) state only

(2) state and accelerometer scale factors {ΔSF_X, ΔSF_Y, ΔSF_Z (ppm) = +151, +43, +15}

Table II. STS-13 solution and comparisons.

OBSERVATION STATISTICS BASED ON FINAL STATE

STATION NO.	NAME	OBSERVATION TYPE	OBSERVATIONS ACCEPTED	AVERAGE WEIGHT. RES.	AVERAGE RESIDUAL	STANDARD STAND. DEV.	WEIGHTED STAND. DEV.
2	KMTC	RANGE	33 OF 33	.14360315E+01	.43162079E+02	.69091119E+02	.22961750E+01
2	KMTC	AZIMUTH	35 OF 35	-.63507418E+00	-.72774140E-02	.14755917E-01	.12876967E+01
2	KMTC	ELEVATION	36 OF 36	.68765455E+00	.93771138E-02	.12841870E-01	.10260081E+01
3	VDBC	RANGE	179 OF 179	.50418422E+00	.15284884E+02	.28847237E+02	.94579771E+00
3	VDBC	AZIMUTH	201 OF 201	.92204027E-01	.10565803E-02	.79039957E-02	.68975375E+00
3	VDBC	ELEVATION	200 OF 200	-.40473678E+00	-.59420154E-02	.55339827E-02	.34551909E+00
4	THE08	AZIMUTH	101 OF 101	-.96664529E+00	-.55384696E-02	.44381177E-02	.77459766E+00
4	THE08	ELEVATION	101 OF 101	.55899779E+00	.32028214E-02	.43241099E-02	.75469955E+00
5	VDSC	RANGE	164 OF 164	-.11295458E+01	-.34161799E+02	.29940402E+02	.98450695E+00
5	VDSC	AZIMUTH	196 OF 196	.30140682E+00	.34538677E-02	.14014205E-01	.12229701E+01
5	VDSC	ELEVATION	197 OF 197	-.16425562E+01	-.23532508E-01	.13894244E-01	.77830860E+00
6	THE01	AZIMUTH	141 OF 141	-.17534938E+00	-.10046779E-02	.28480631E-02	.49708079E+00
6	THE01	ELEVATION	141 OF 141	.35663527E+00	.20433696E-02	.25141033E-02	.43879381E+00
8	THE09	AZIMUTH	137 OF 137	-.32852125E+00	-.18822881E-02	.39639594E-02	.69184143E+00
8	THE09	ELEVATION	137 OF 137	-.18208203E-01	-.10432532E-03	.21573215E-02	.37652363E+00
9	FRCC	RANGE	247 OF 247	-.10410587E+00	-.30805330E+01	.26218759E+02	.86576941E+00
9	FRCC	AZIMUTH	258 OF 258	.17873794E+00	.20481859E-02	.18507270E-01	.16150639E+01
9	FRCC	ELEVATION	267 OF 267	.56972462E+00	.65391549E-02	.15801736E-01	.13334905E+01
10	EAFC	RANGE	262 OF 262	-.14904674E+01	-.45014800E+02	.31447478E+02	.10384619E+01
10	EAFC	AZIMUTH	269 OF 269	-.74226143E+00	-.85056895E-02	.21814643E-01	.19036867E+01
10	EAFC	ELEVATION	281 OF 281	.41805010E+00	.49747786E-02	.15404607E-01	.12778580E+01
11	THE07	AZIMUTH	107 OF 107	-.22005444E+00	-.12608191E-02	.29502514E-02	.51491601E+00
11	THE07	ELEVATION	107 OF 107	-.71266067E+00	-.40832449E-02	.28604807E-02	.47924806E+00
12	GDSS	RANGE	149 OF 149	.27525285E-01	.27027852E+00	.47208022E+01	.41956331E+00
12	GDSS	DOPPLER	148 OF 148	.77467031E-01	.78053777E-01	.60127330E+00	.60015389E+00
12	GDSS	X-ANGLE	149 OF 149	-.34348604E+00	-.51141591E-02	.96942046E-02	.69596922E+00
12	GDSS	Y-ANGLE	148 OF 148	-.28155379E+00	-.32283256E-02	.97971981E-02	.85461347E+00
14	KPTC	RANGE	116 OF 116	.30043012E+00	.90630862E+01	.29379206E+02	.96408031E+00
14	KPTC	AZIMUTH	141 OF 141	.55003935E+00	.63029867E-02	.62020180E-02	.54122817E+00
14	KPTC	ELEVATION	142 OF 142	.71865561E+00	.10015243E-01	.93735884E-02	.65575295E+00
15	SNFC	RANGE	148 OF 148	-.75651867E+00	-.22924288E+02	.25089651E+02	.82420504E+00
15	SNFC	AZIMUTH	174 OF 174	.84224559E-01	.96514235E-03	.51774048E-02	.45181386E+00
15	SNFC	ELEVATION	175 OF 175	-.10591441E+01	-.15829305E-01	.84250029E-02	.51691525E+00
16	THE15	AZIMUTH	101 OF 101	-.12370451E+00	-.70877465E-03	.11878279E-02	.20731503E+00
16	THE15	ELEVATION	101 OF 101	-.64498836E+00	-.36955111E-02	.17055062E-02	.29766599E+00
20	EFFC	RANGE	186 OF 186	.33903389E+00	.10237640E+02	.40670793E+02	.13415434E+01
20	EFFC	AZIMUTH	186 OF 186	.12592004E+00	.14429374E-02	.16925130E-01	.14769962E+01
20	EFFC	ELEVATION	199 OF 199	-.15118835E+00	-.25260372E-02	.17427704E-01	.14144159E+01

TOTAL WEIGHTED FIT STATISTICS--- NOBS = 6060 WGT. MEAN = -.16531825E+00 WGT. STD. DEV. = .11928944E+01

Table III. STS-13 residual summary.

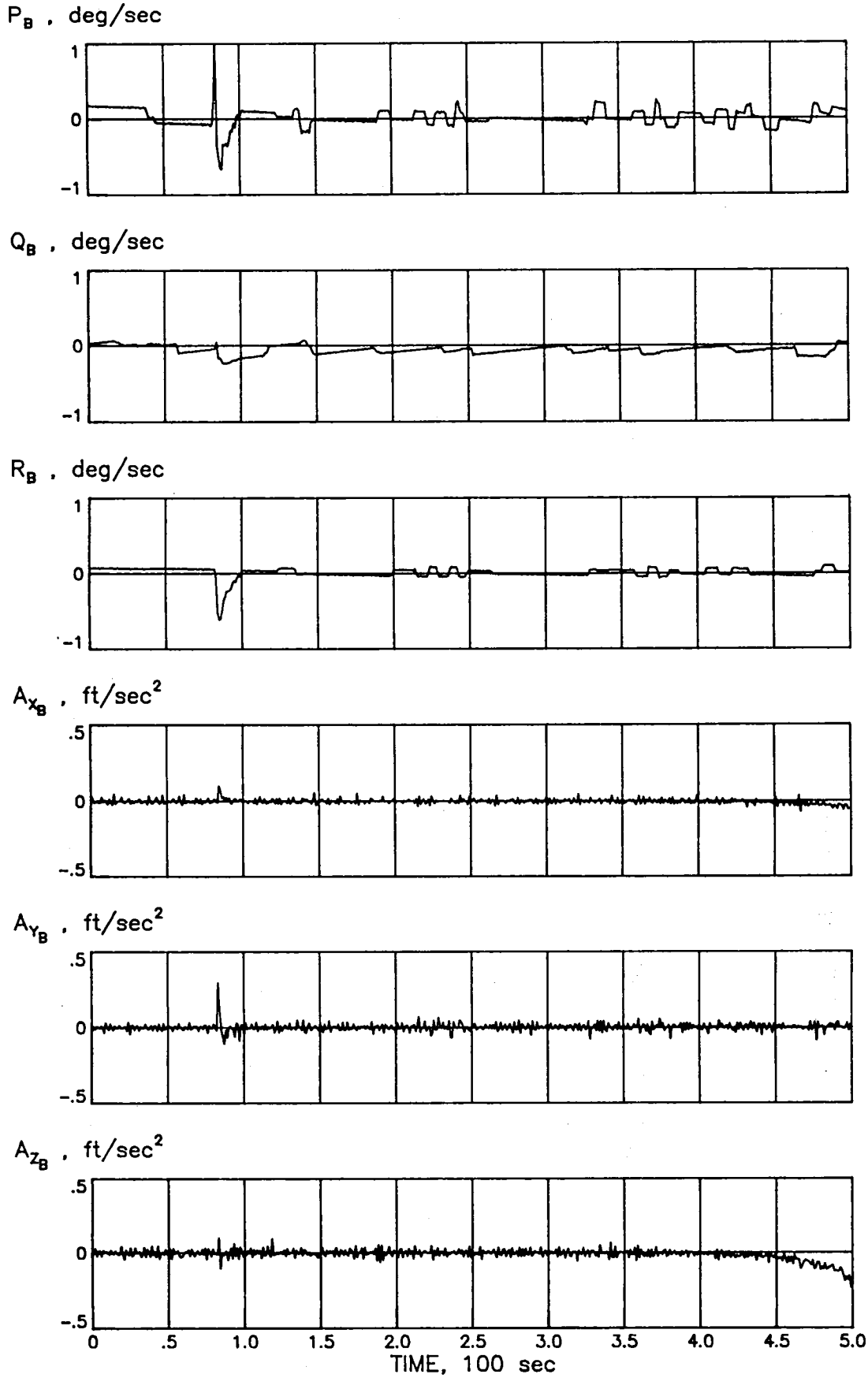


Figure I-1. STS-13 Dynamic data , IMU 2

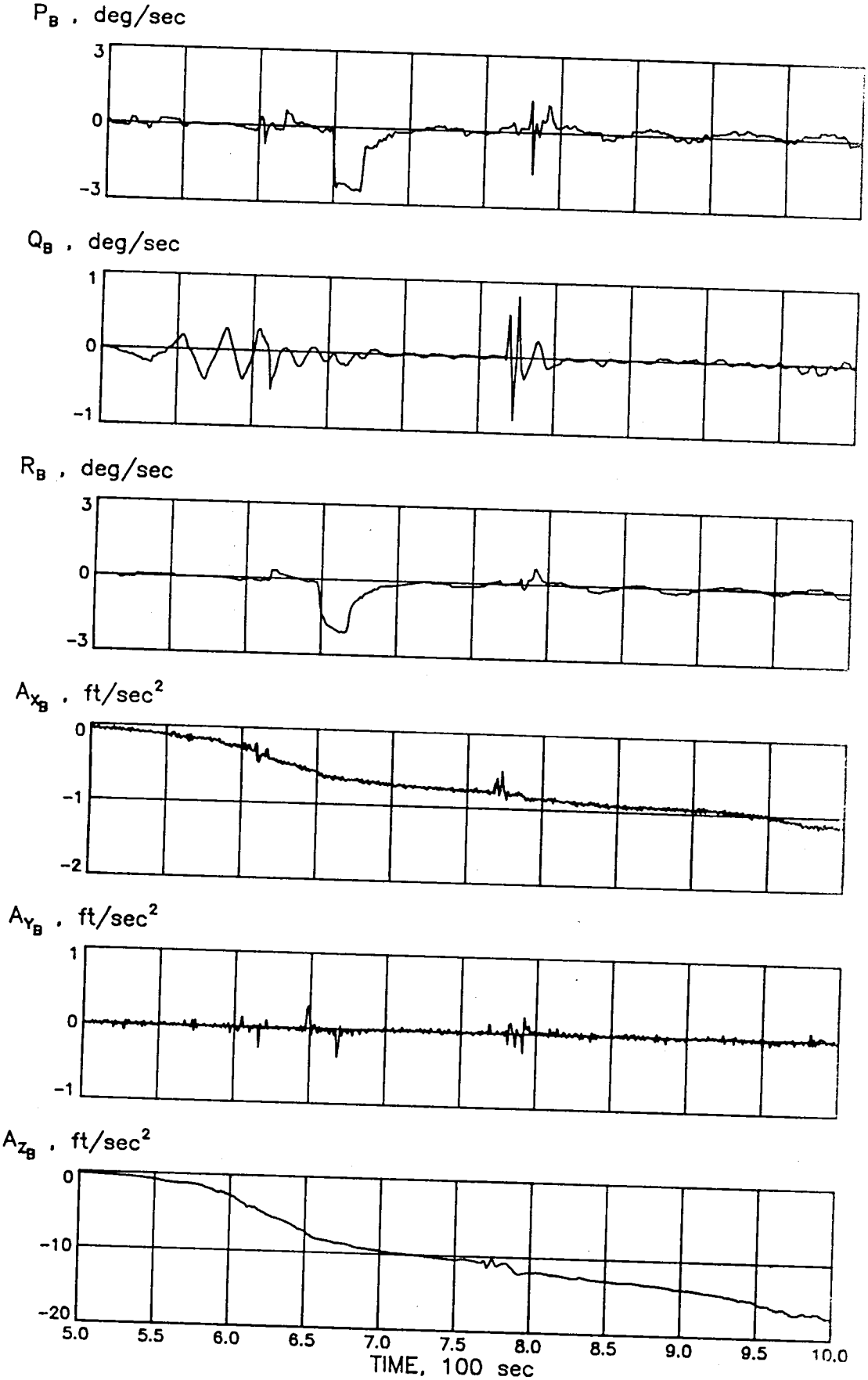


Figure I-1. (continued)

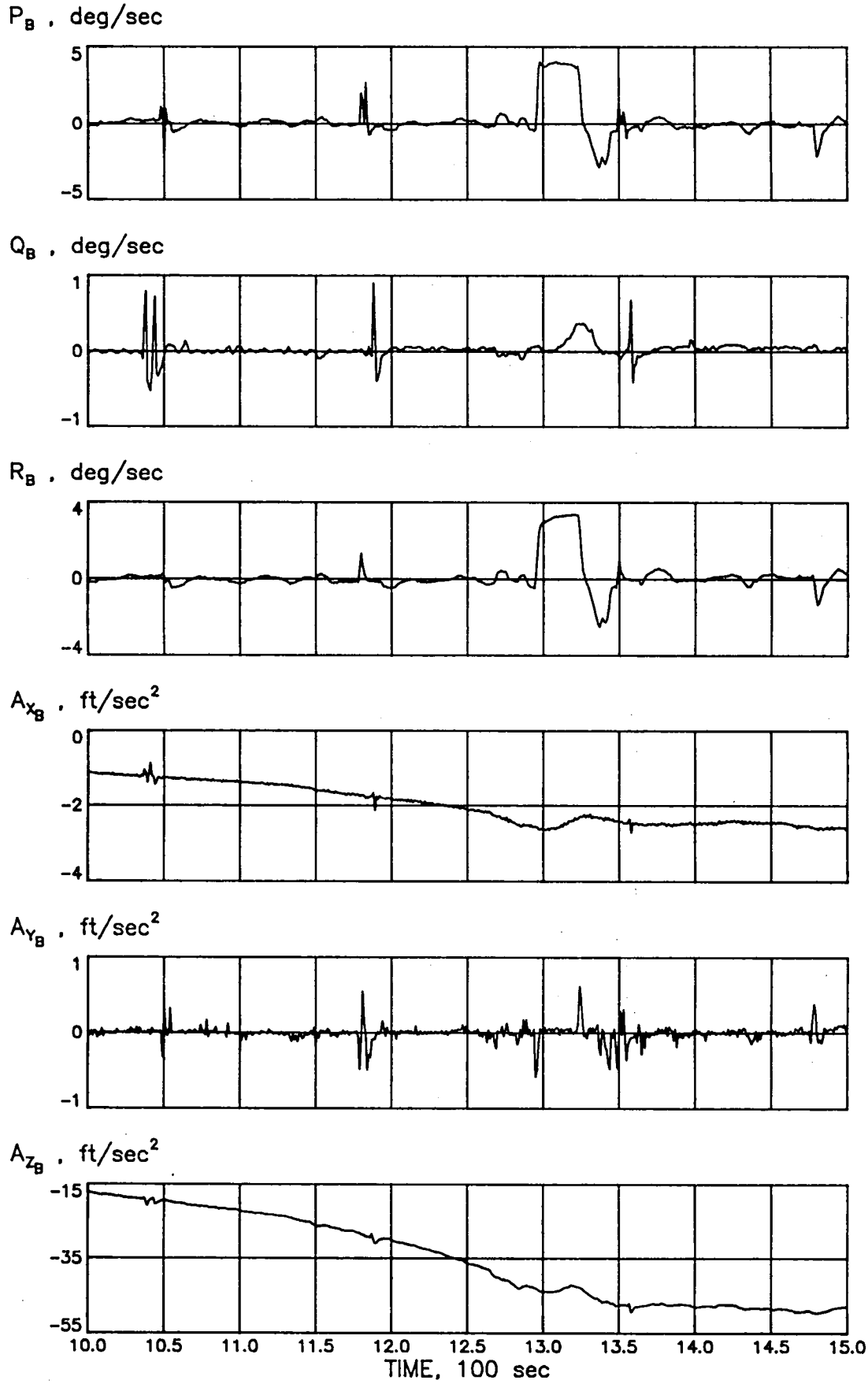


Figure I-1. (continued)

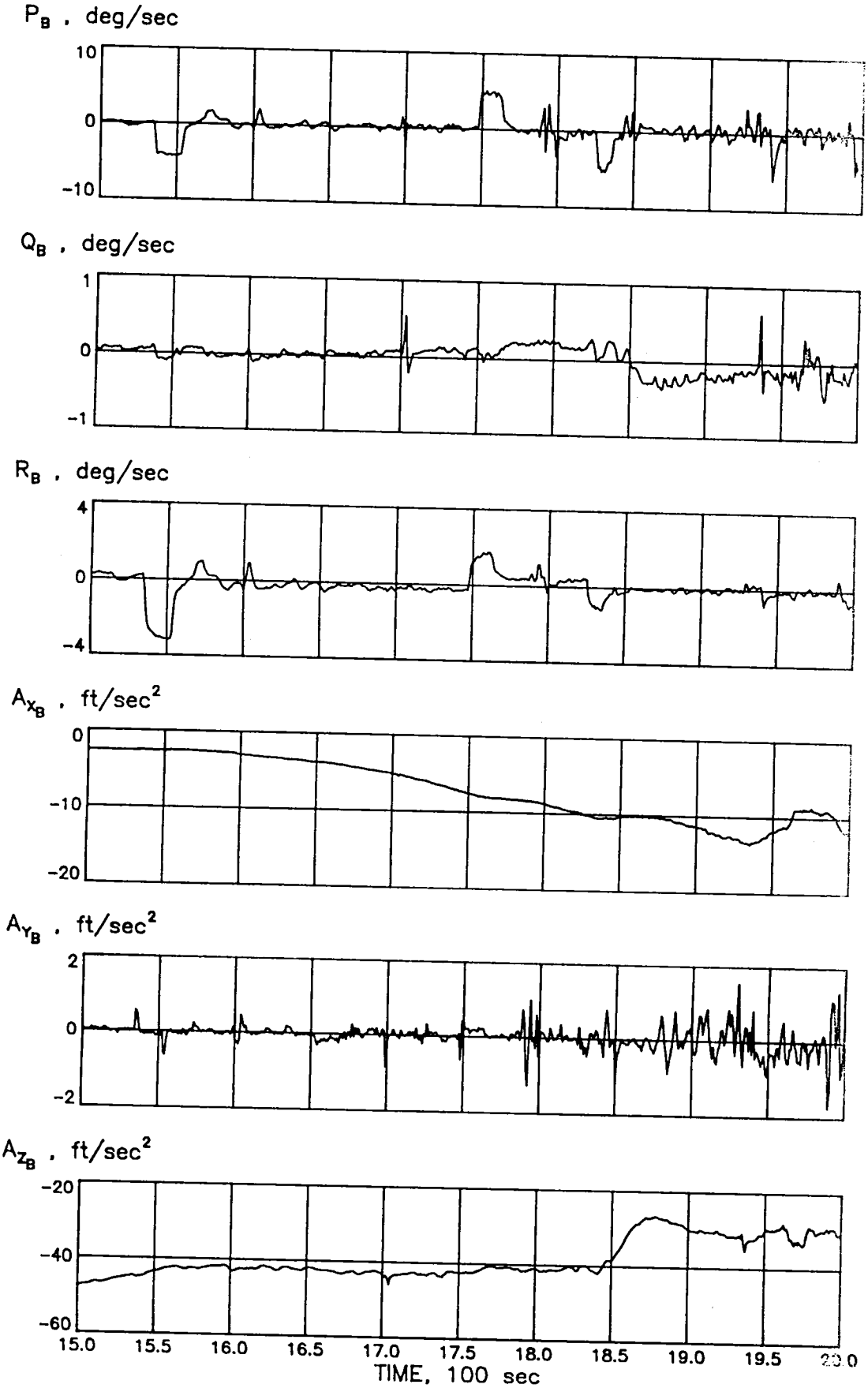


Figure I-1. (continued)

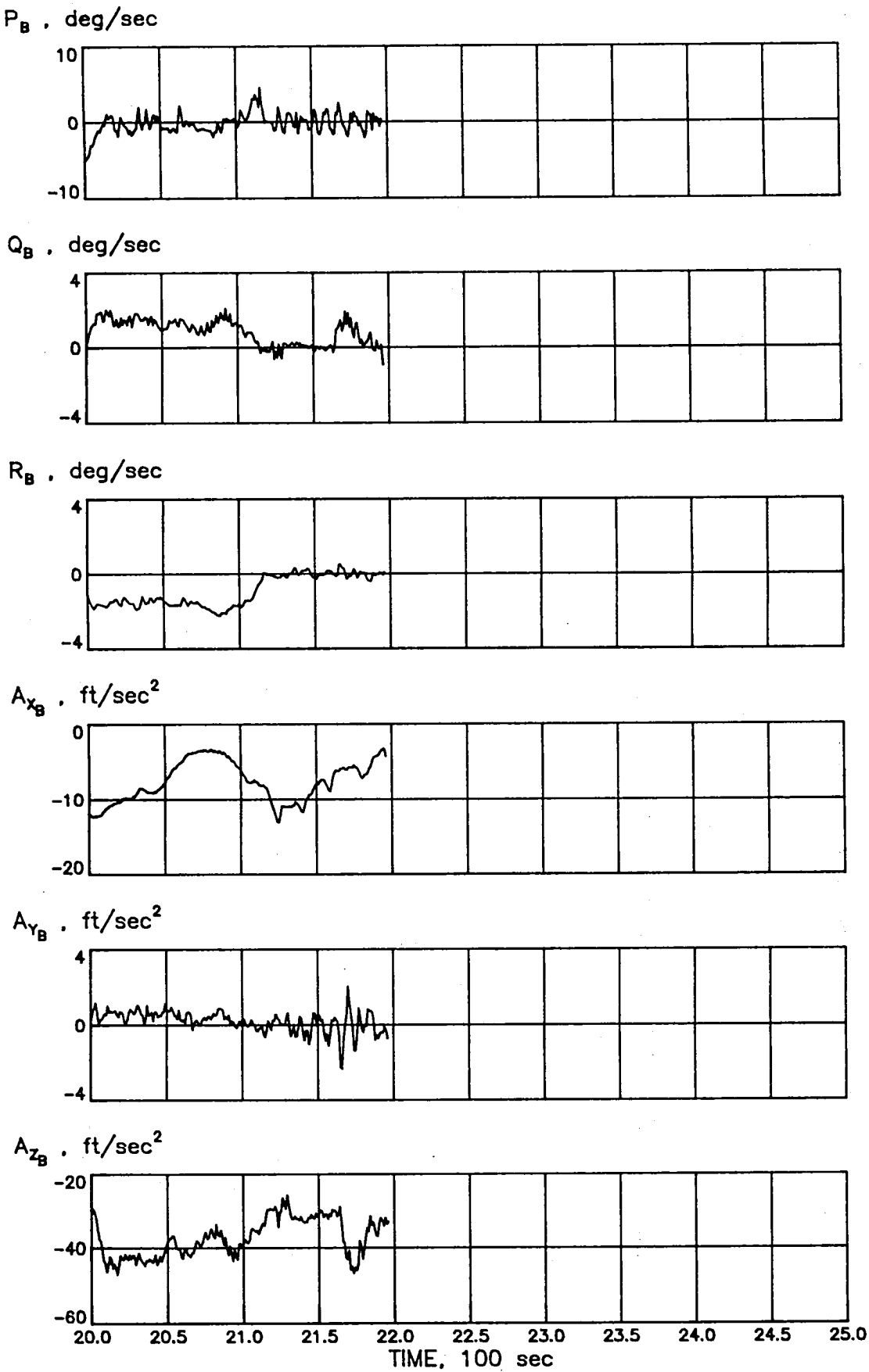


Figure I-1. (concluded)

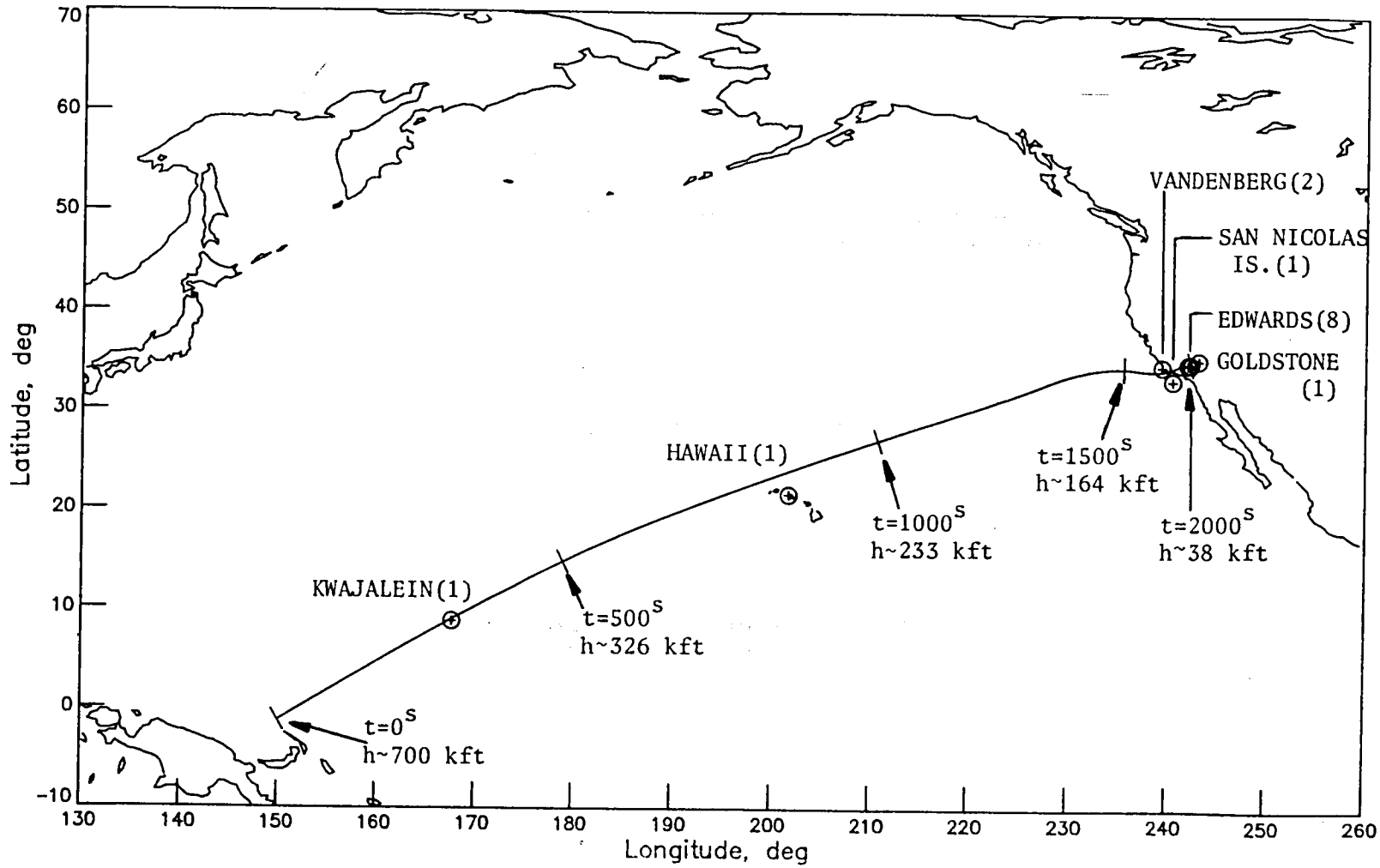
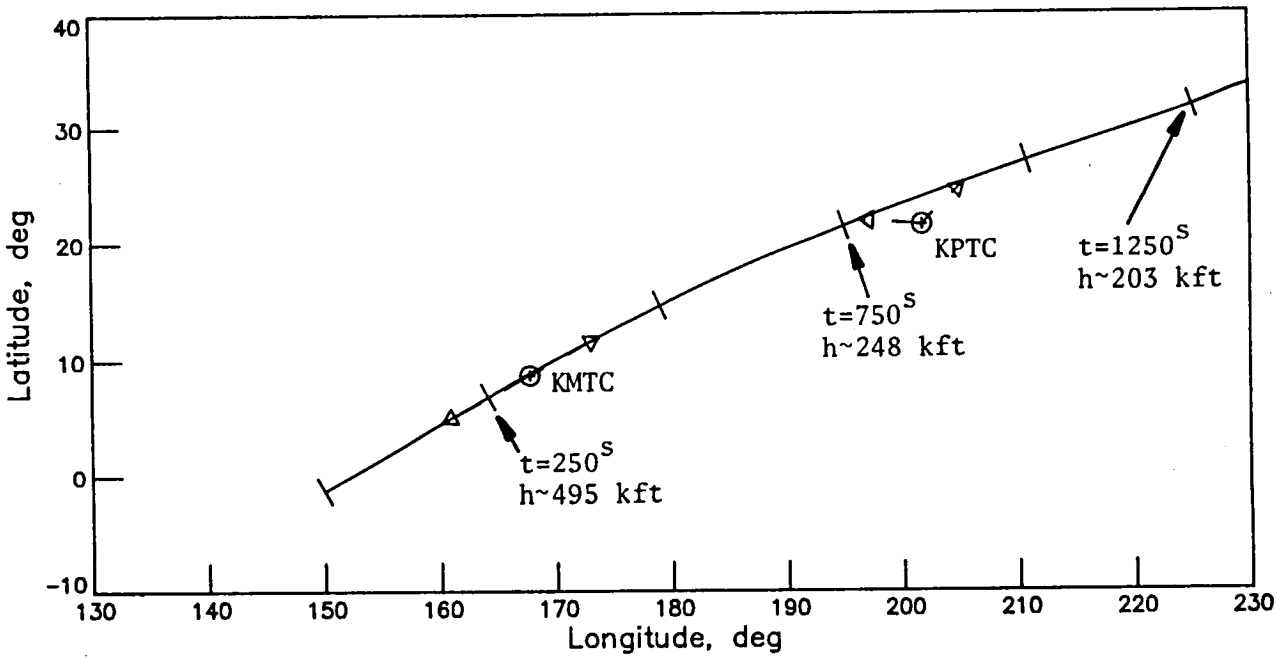
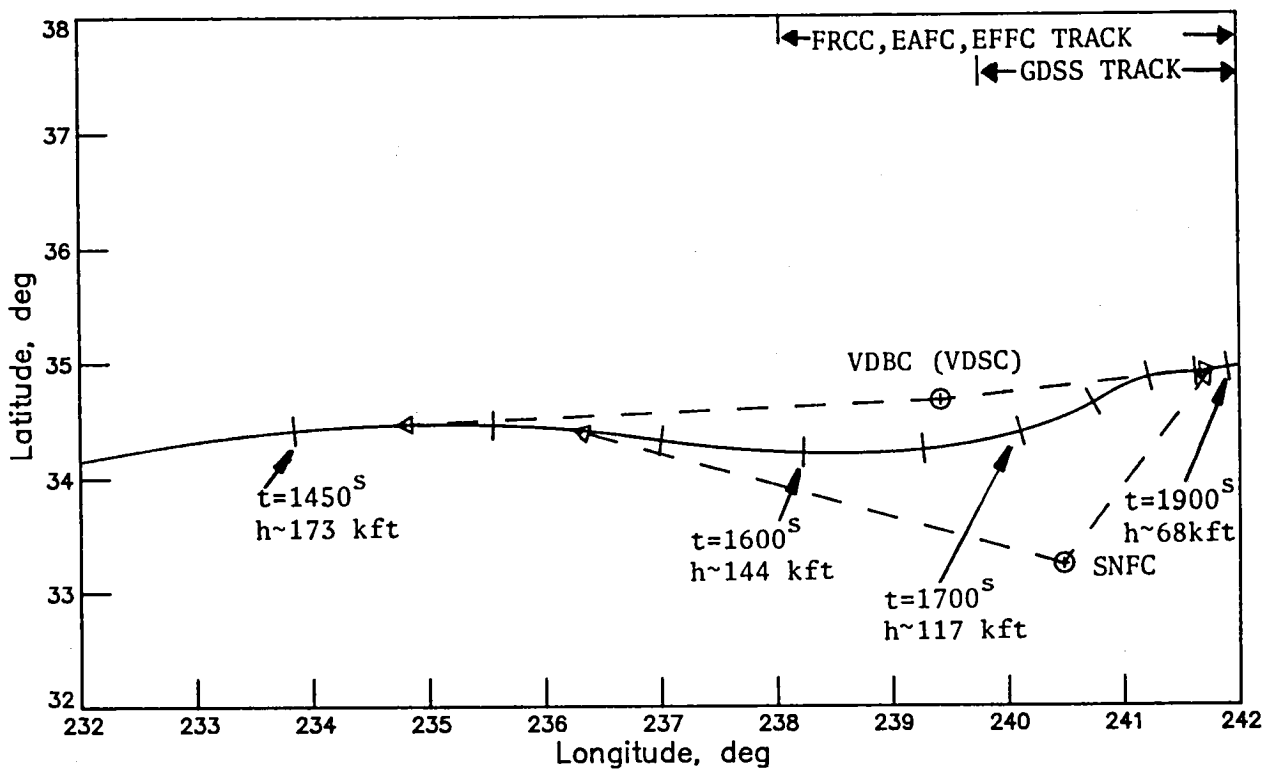


Figure I-2. STS-13 ground track from epoch to touchdown.

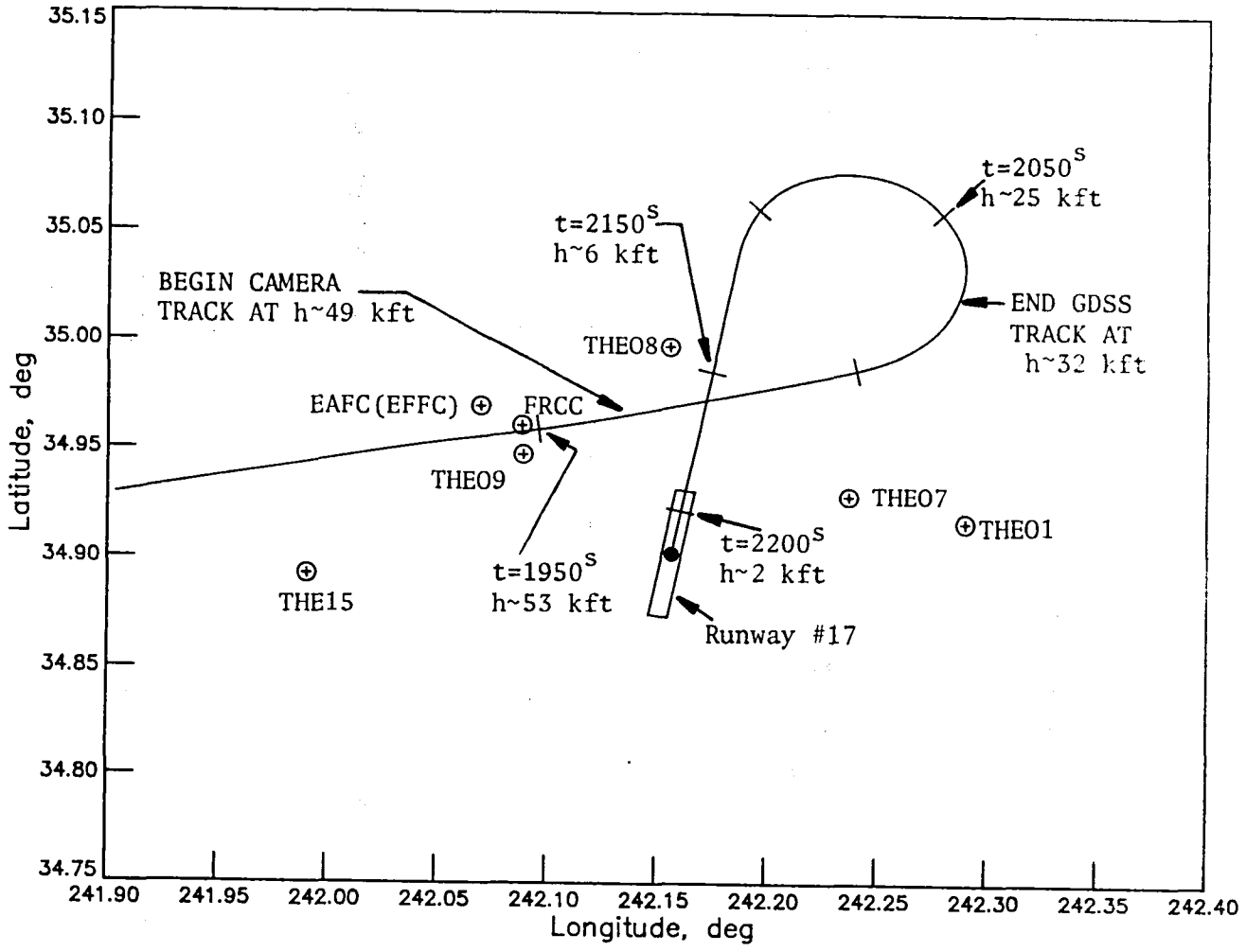


(a) Entry to California C-band acquisition.



(b) California C-band acquisition to final approach

Figure I-3. Detailed tracking coverage for STS-13.



(c) Final approach and landing

Figure I-3. (concluded).

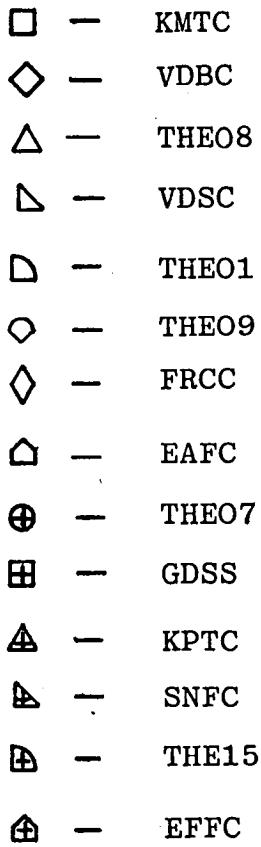


Figure I-4. Key for following three composite residual plots.

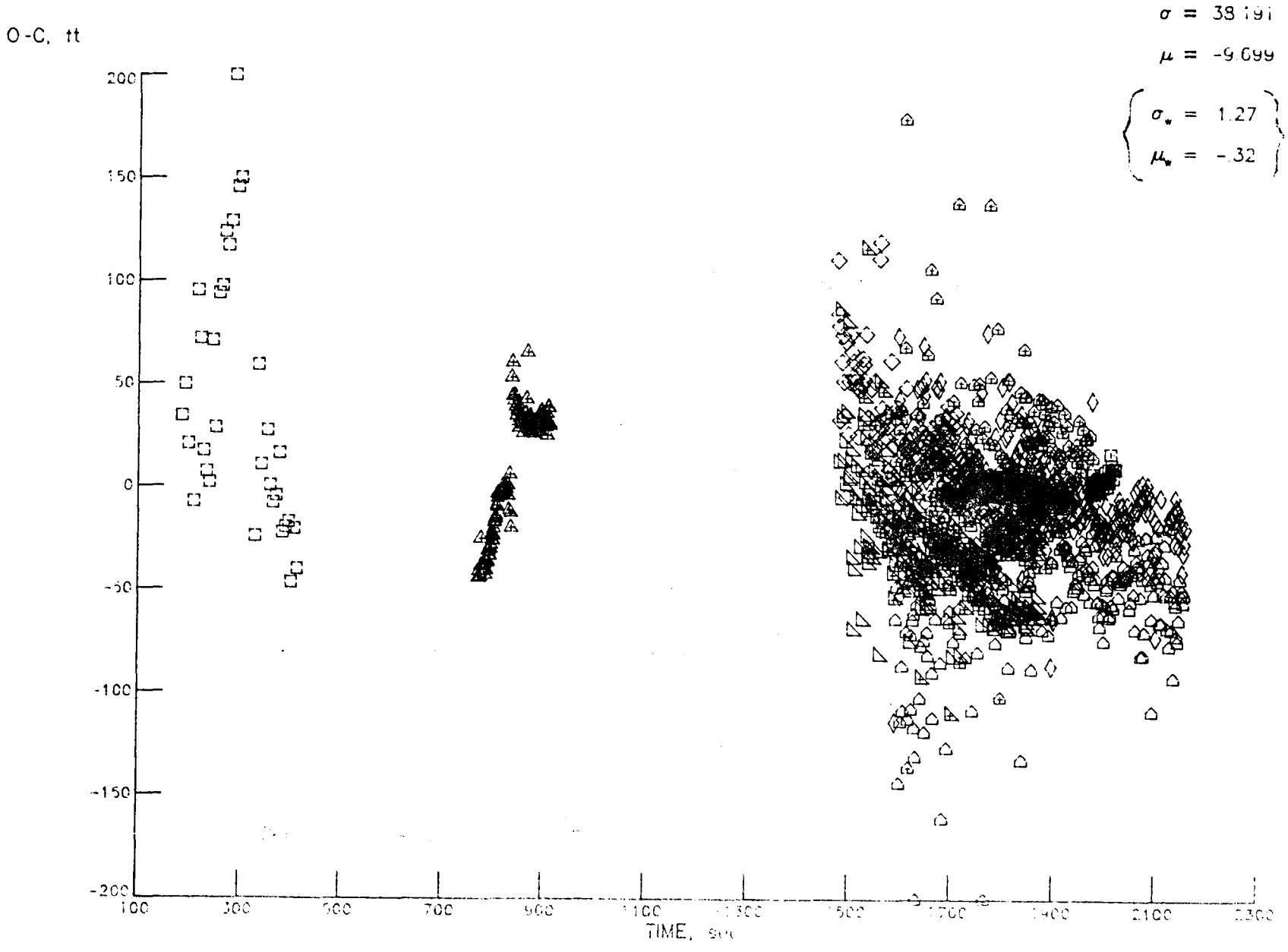


Figure I-5. STS-13(41C) composite range residuals.

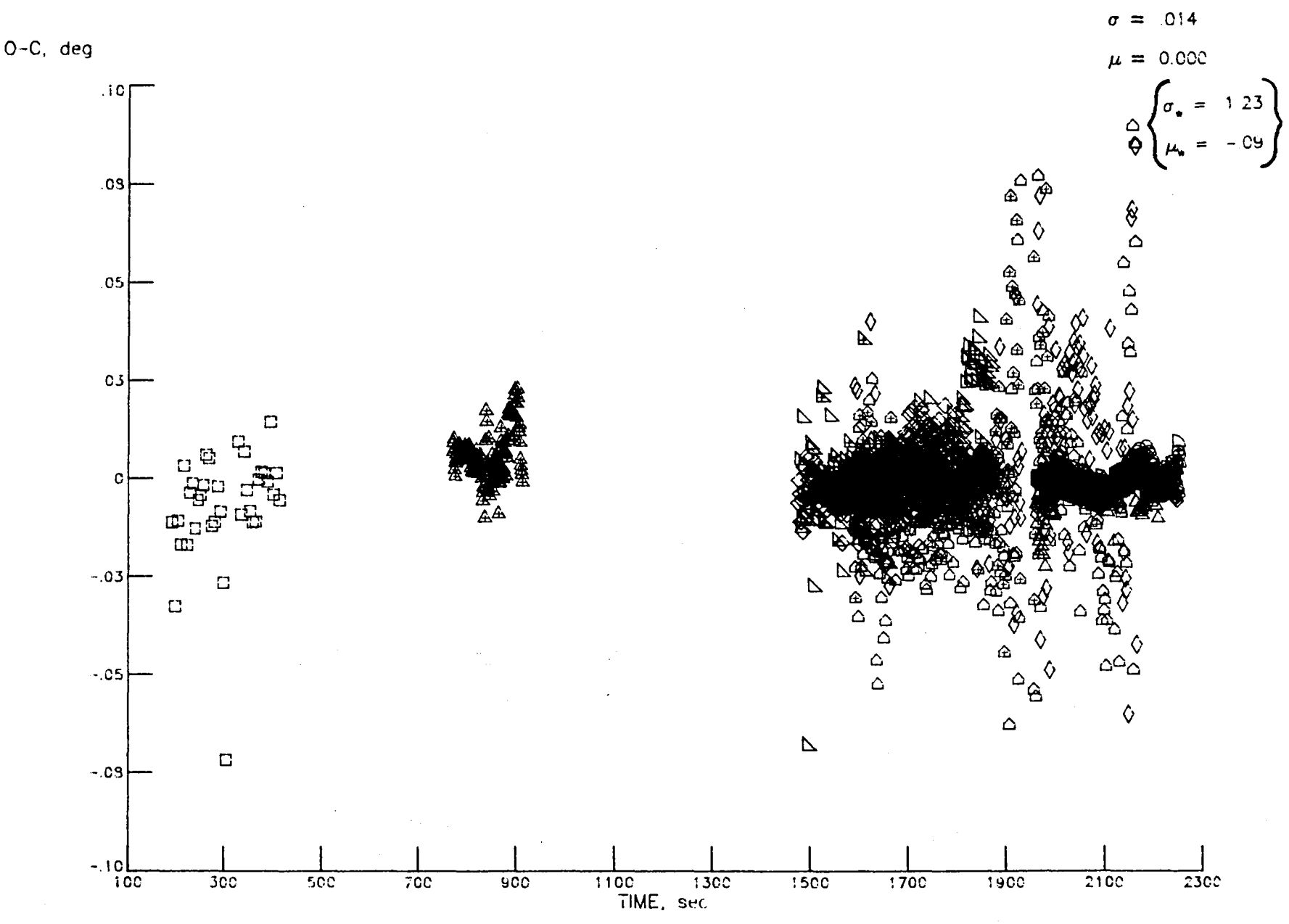


Figure I-6. STS-13(41C) composite azimuth residuals.

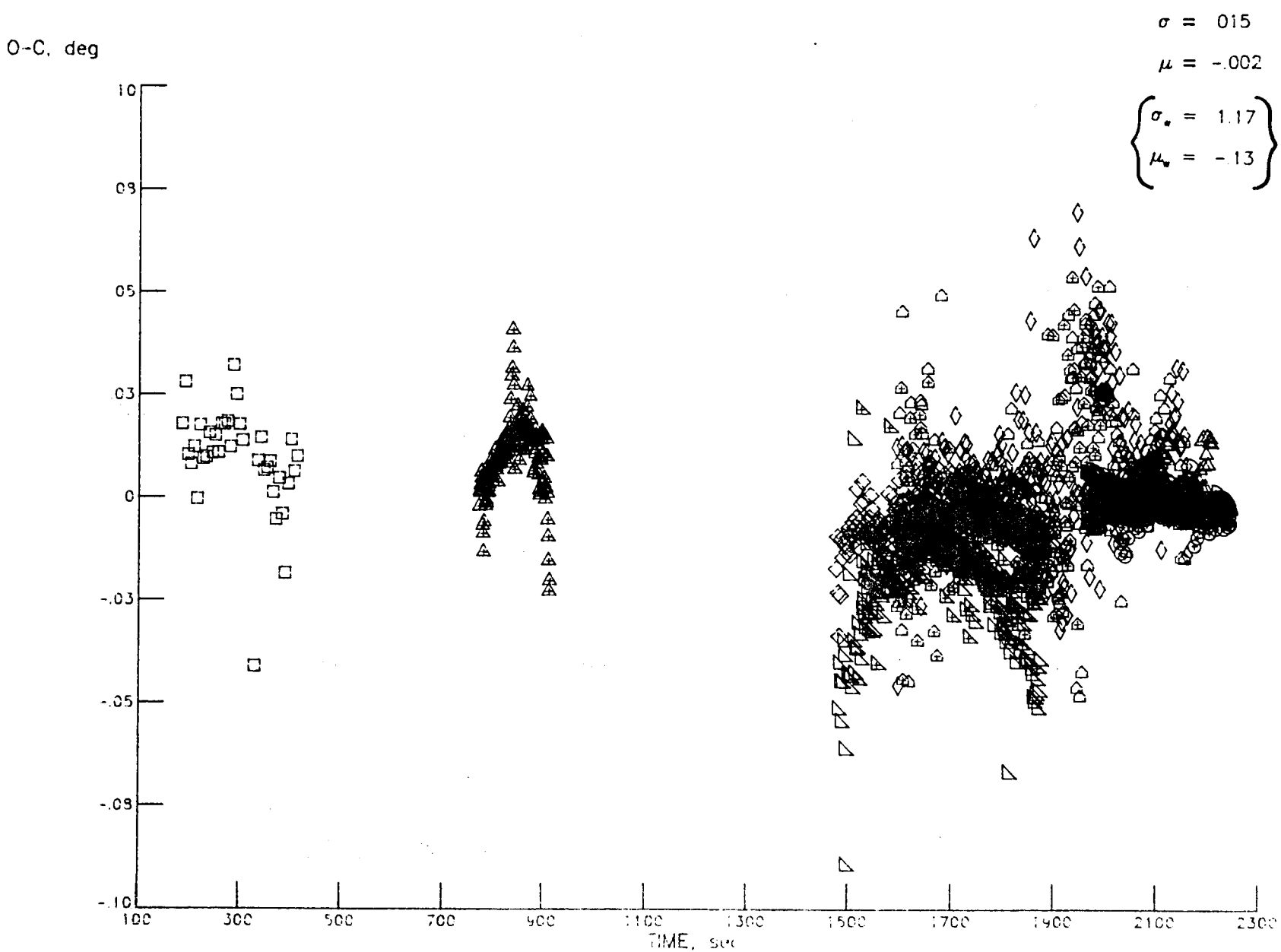


Figure I-7. STS-13(41C) composite elevation residuals.

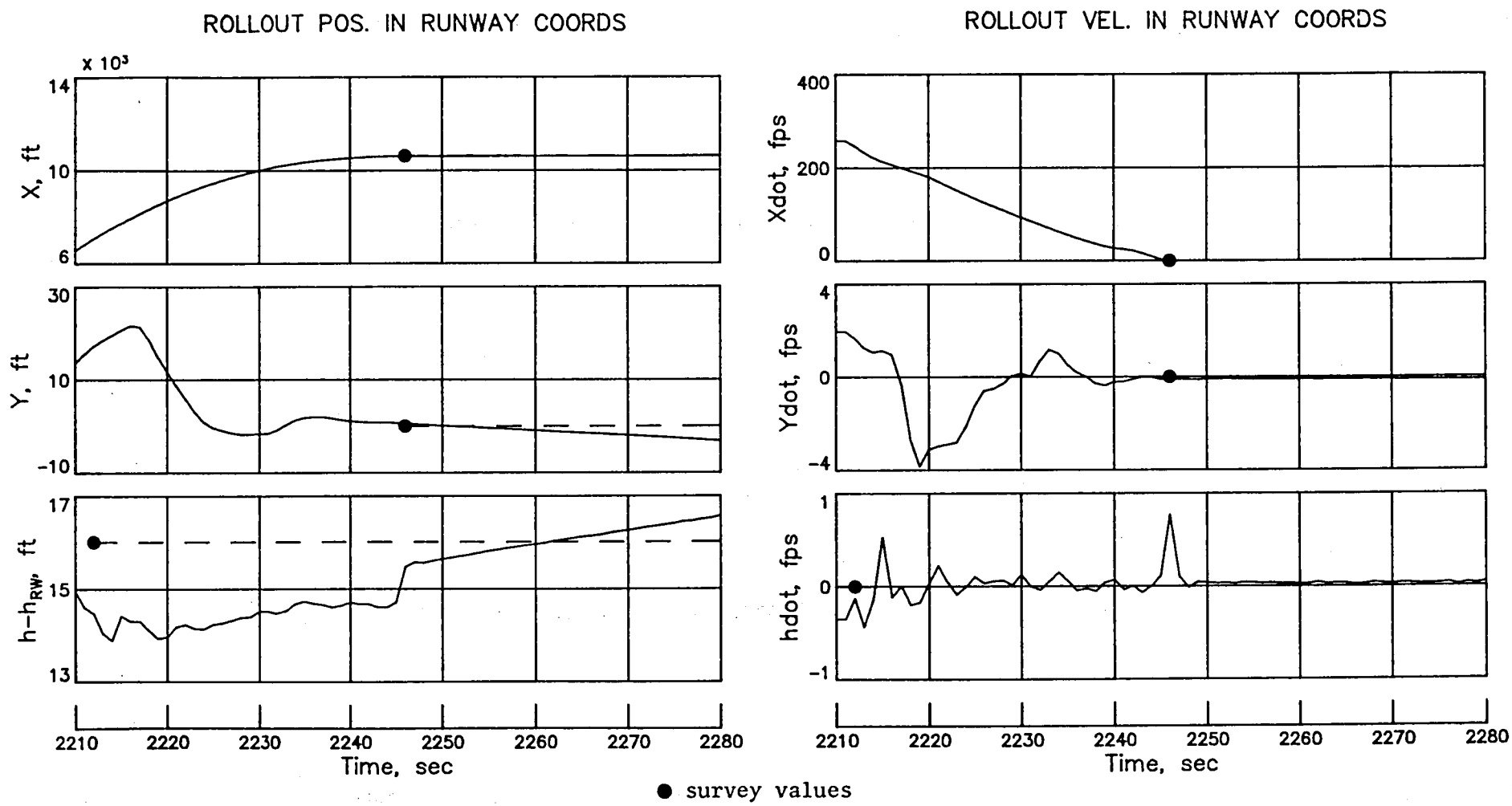


Figure I-8. Rollout position and velocity plots for STS-13.

II. Extended BET

Receipt of the remote atmospheric data at LaRC was later than usual. In the interim, the JSC/TRW BET had been received and the NOAA "totem-pole" atmosphere utilized therein reformatted as a LAIRS file. The NOAA data, apart from some of the more sharper curvature shown in Figure II-1 and II-2 for the C_N derived density, seemingly provided for an excellent density profile. Winds during the subsonic regime were also deemed proper by comparing same with that expected from the Rockwell post flight side-probe measurements. Prior to adopting these data, several LaRC files were evaluated. The first three LAIRS files were entirely too dense at altitude near 250 kft. The last LAIRS file, ST13MEY, had structure similar to the NOAA data throughout though an additional five(5) percent data base overprediction would have been implied. Thus, the NOAA data were adopted. The LAIRS formatted version of the NOAA data is NOAA13/UN=581199C. This file was merged with the inertial BET (BT13M23) to create the Extended BET (ST13BET/UN=274885C).

Ambient atmospheric parameters presented, plotted over the lowermost 400 kft, are temperature (Figure II-3), density (Figure II-4), pressure (Figure II-5), and winds (Figure II-6). More details on the winds encountered during subsonic flight are given in Figures II-7 through II-9.

Alternate wind measurements used for subsonic wind evaluation were available from four jimsphere balloons deployed over a 5-hour interval about landing (L). The winds obtained from each of these balloons are shown in Figure II-7. Wind magnitude, direction and horizontal components are illustrated. The highest altitude for which winds were available is h~26 kft, as measured by the L-1$\frac{1}{2}$ hr balloon (B3). Furthermore, winds from the most timely balloon (B4), launched at L + 15 minutes, were only available to h~16 kft. A three-minute dropout in the coverage from B2, launched at L-3 hours, resulted in the loss of wind measurements in the interval 16 kft<h<20 kft. The segmented coverage from B2 is designated B2A and B2B on Figure II-7.

The Rockwell post-flight calibrated ADS file was also utilized as an independent source of wind information for STS-13. Estimated winds, batch and deterministic, derived using the ADS file and the inertial BET, are shown together with the most timely jimsphere winds (B4, B3) and the

NOAA winds as Figure II-8. For altitudes below ~20 kft there is fairly good agreement among all sources. Throughout the interval 20 kft<h<40 kft, the magnitude of the NOAA winds is ~10 fps less than the estimates obtained from the side-probe data. Equivalently, these differences are shown in Figure II-9. Plots of the differences between the side-probe air data measurements (α, β , V_T) and the BET computed values based on the NOAA winds are shown thereon. Since the level of agreement in the air relative quantities is considered acceptable, the NOAA winds were chosen as the subsonic wind source for STS-13.

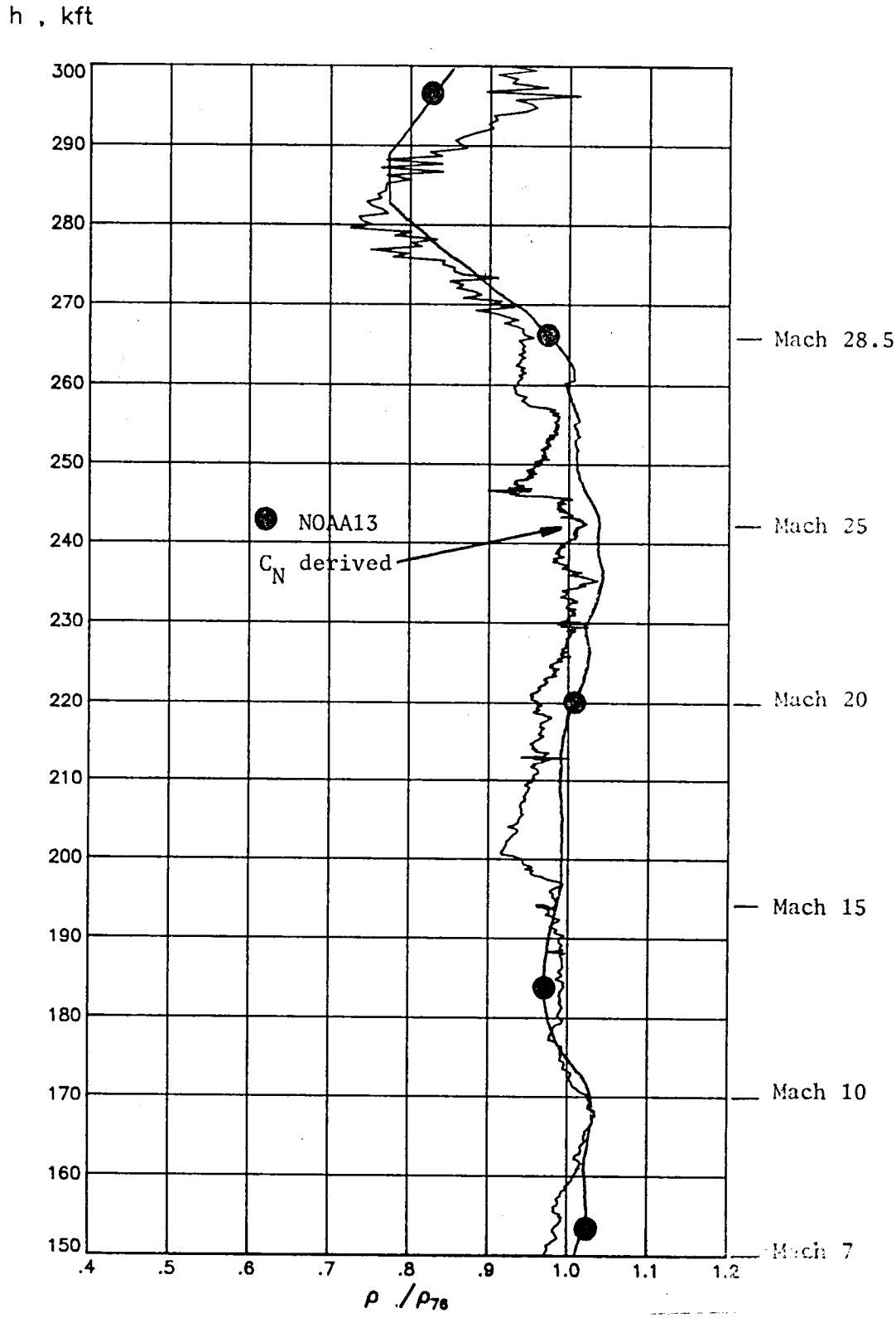


Figure II-1. STS-13(41-C) density comparisons in uppermost altitude interval.

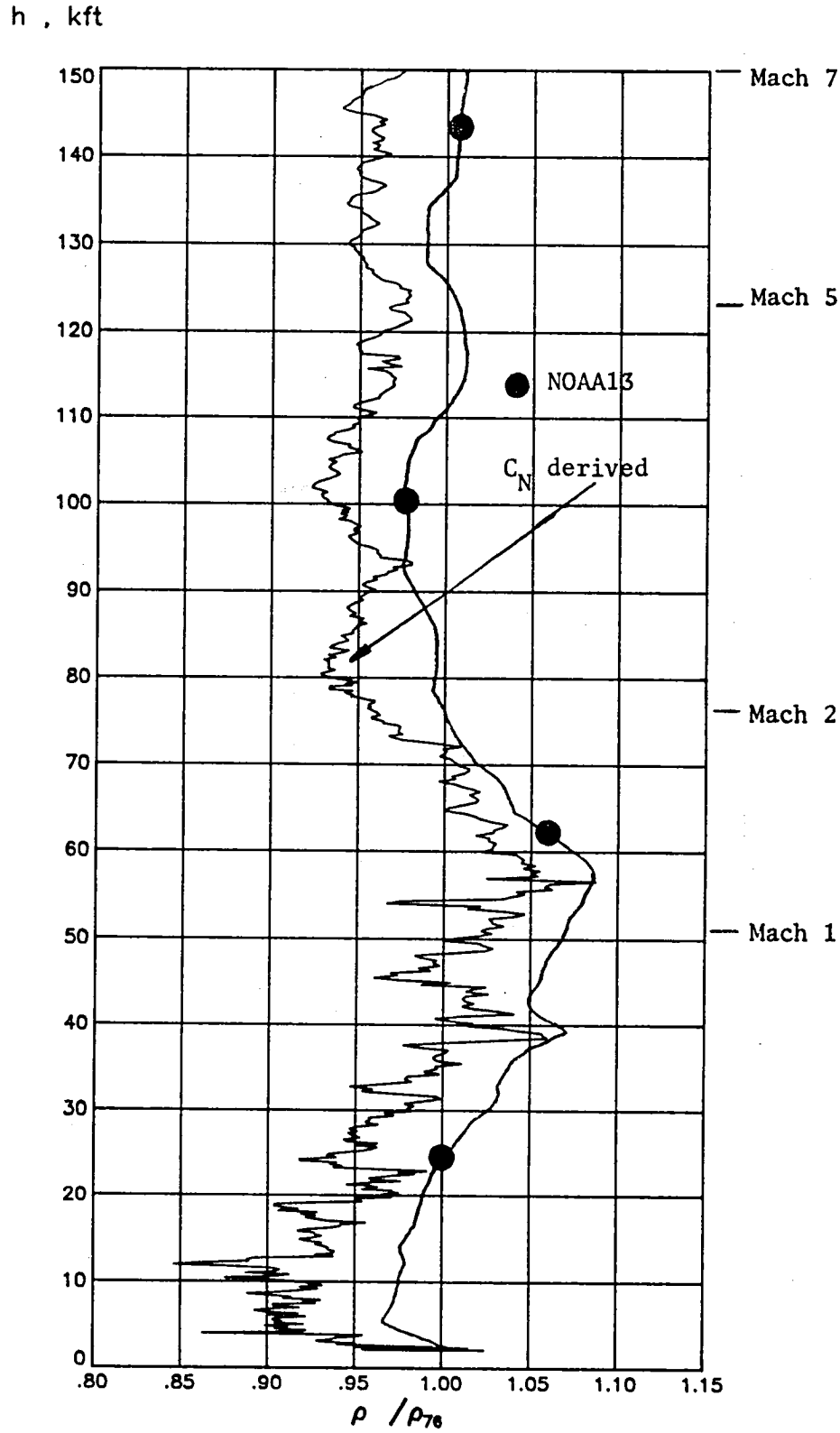


Figure II-2. STS-13(41-C) density comparisons over lowermost altitude interval.

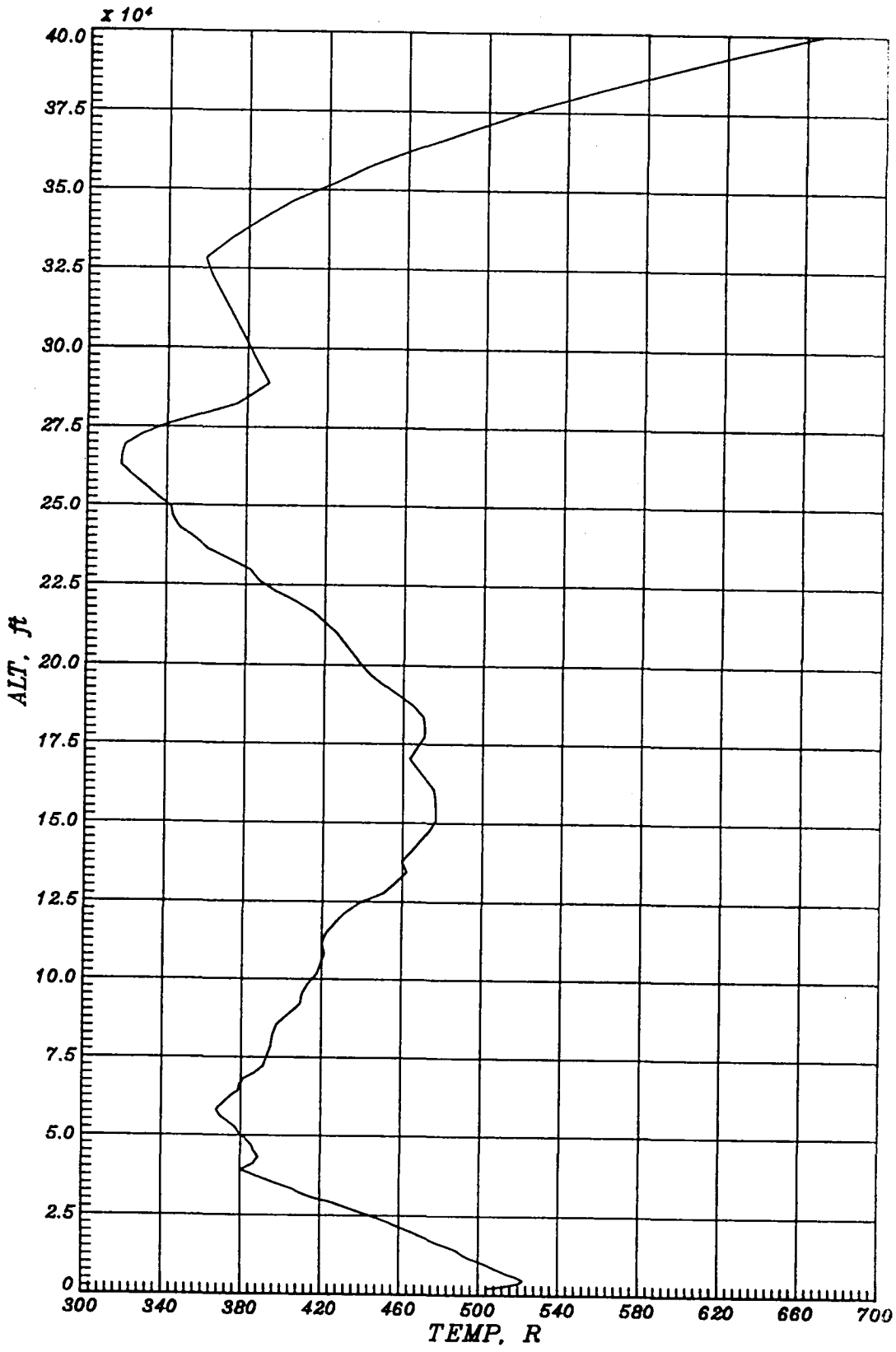


Figure II-3. Final STS-13(41C) temperature profile.

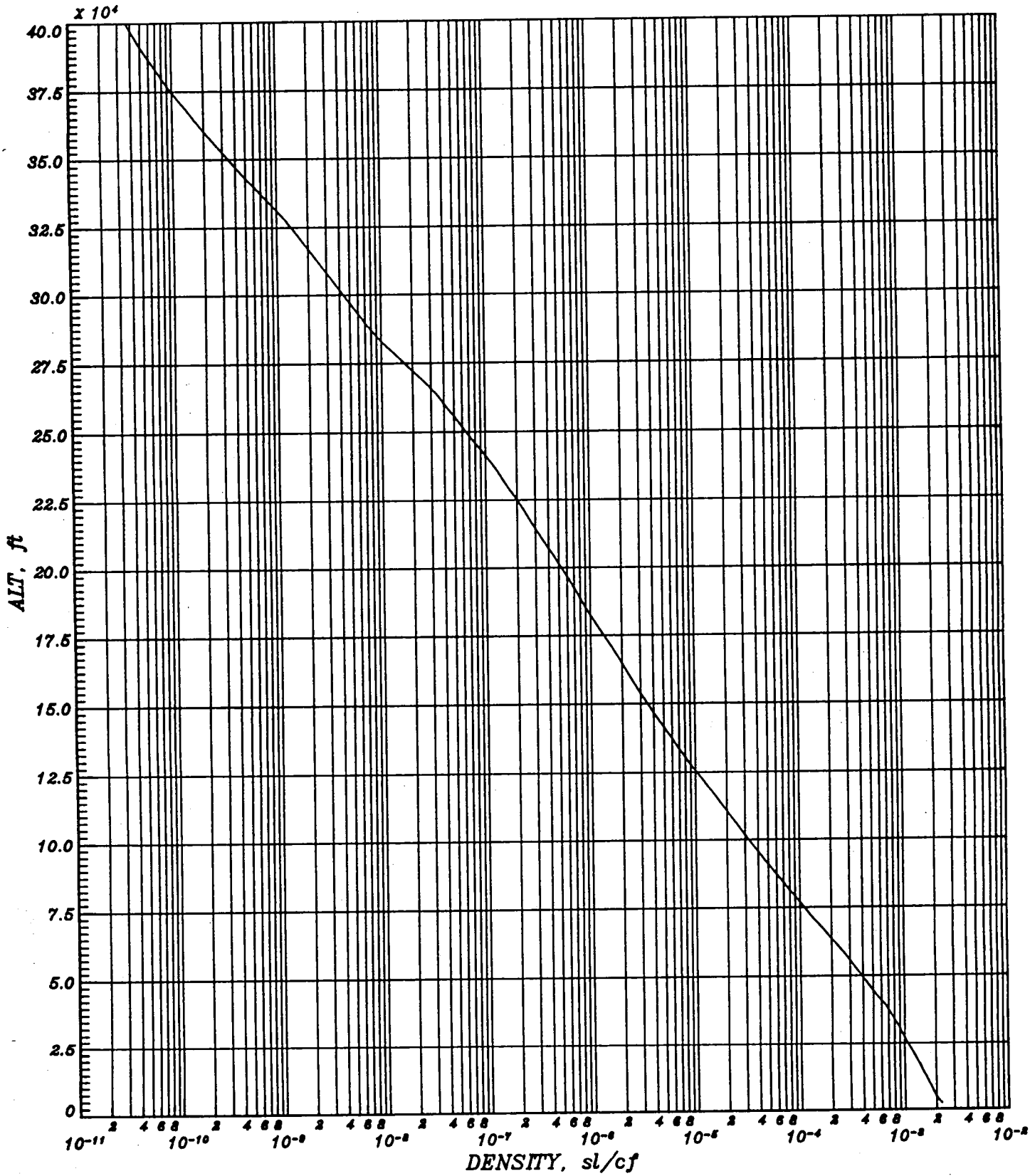


Figure II-4. Final STS-13(41C) atmospheric density profile.

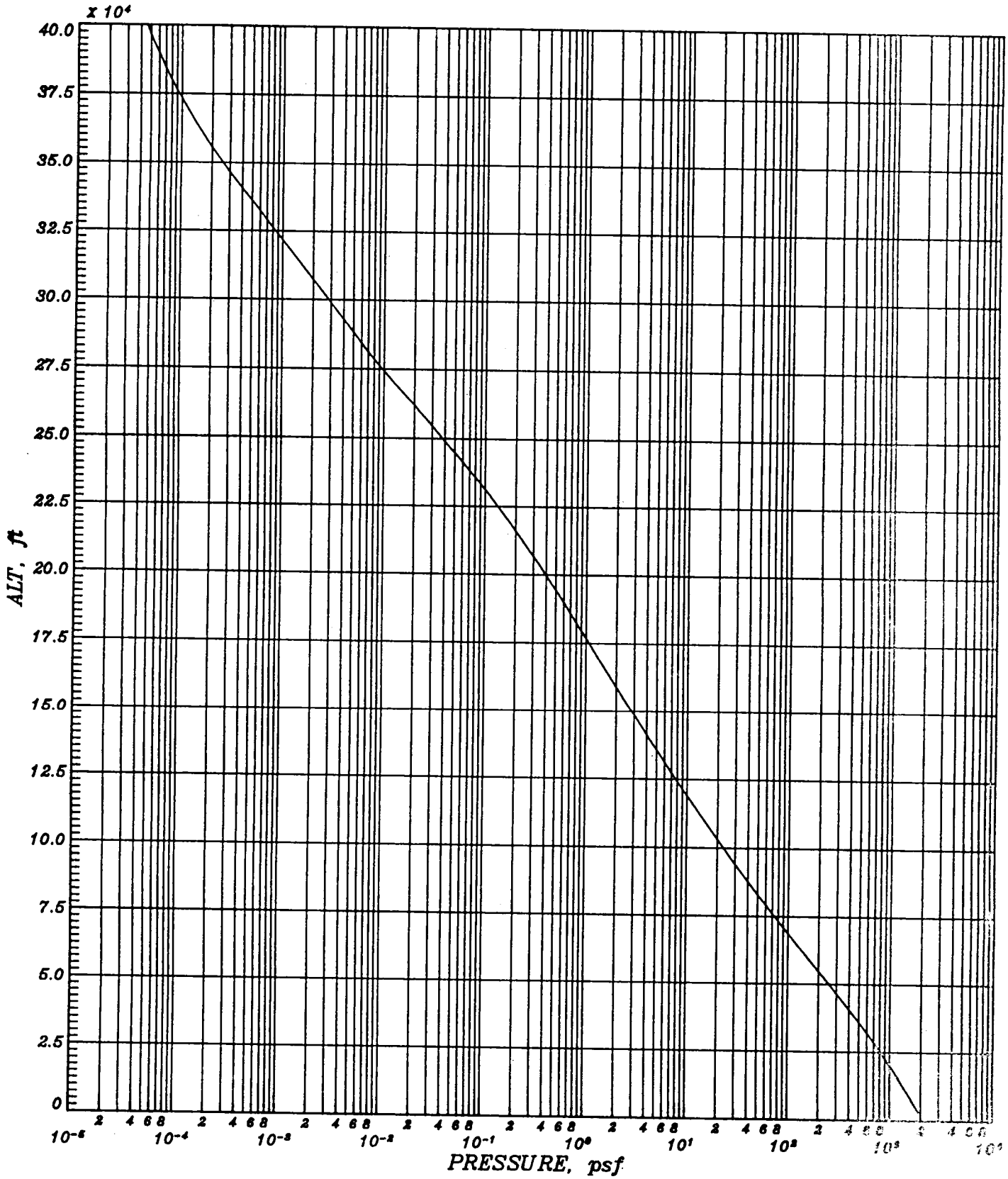


Figure II-5. Final STS-13(41C) atmospheric pressure profile.

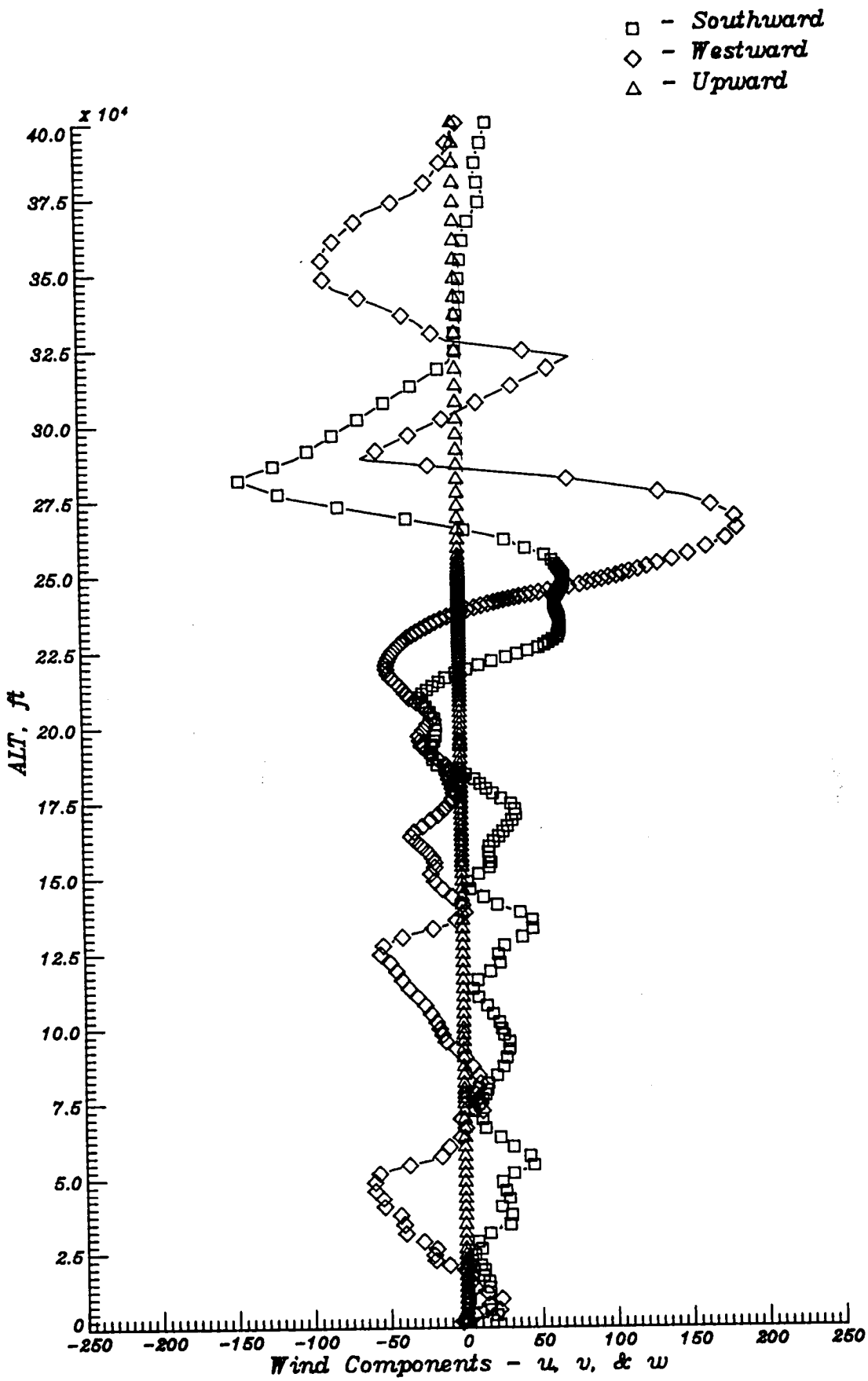


Figure II-6. Final STS-13(41C) atmospheric wind profile.

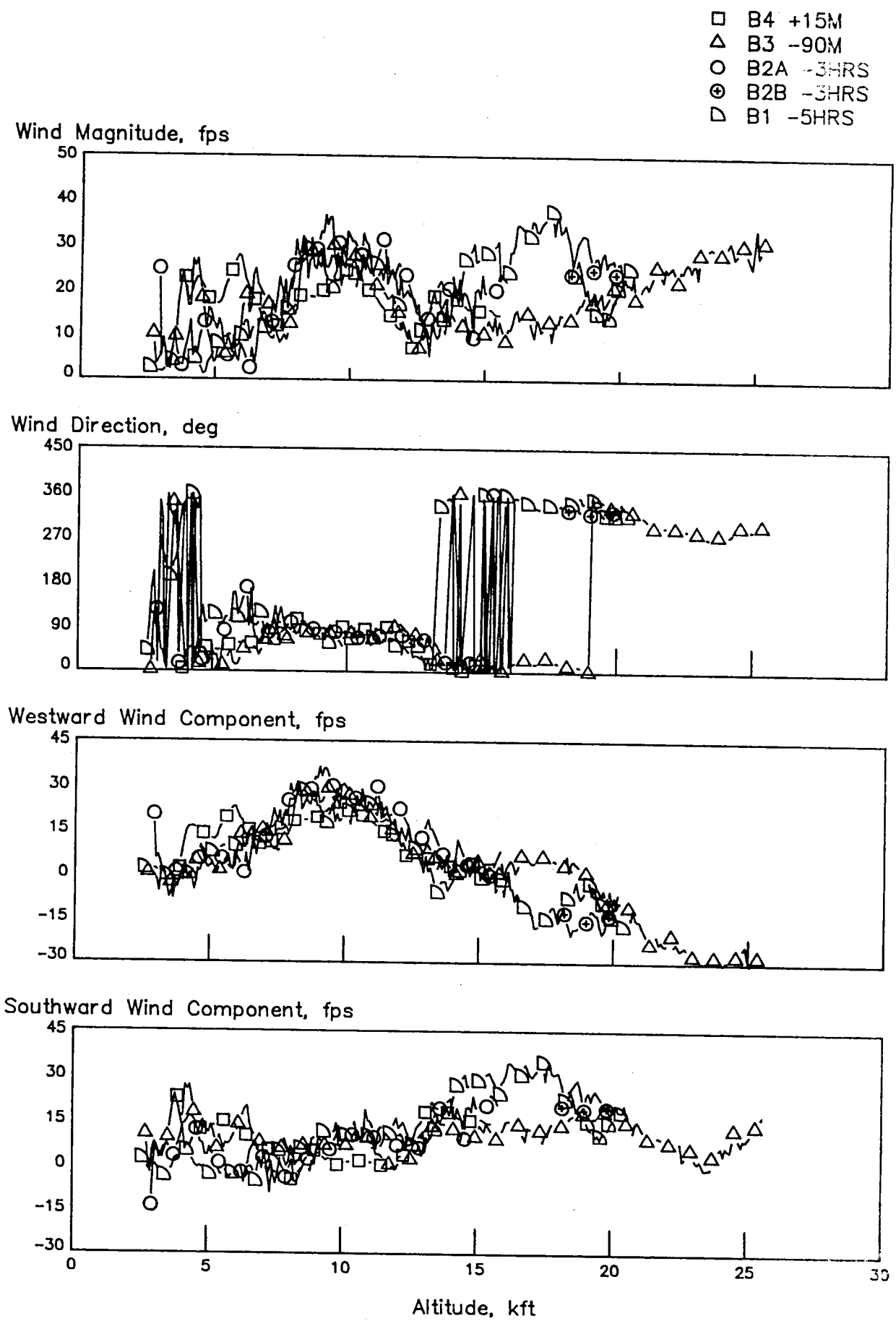


Fig.II-7.STS-13 Jimsphere Winds (4 Balloons)

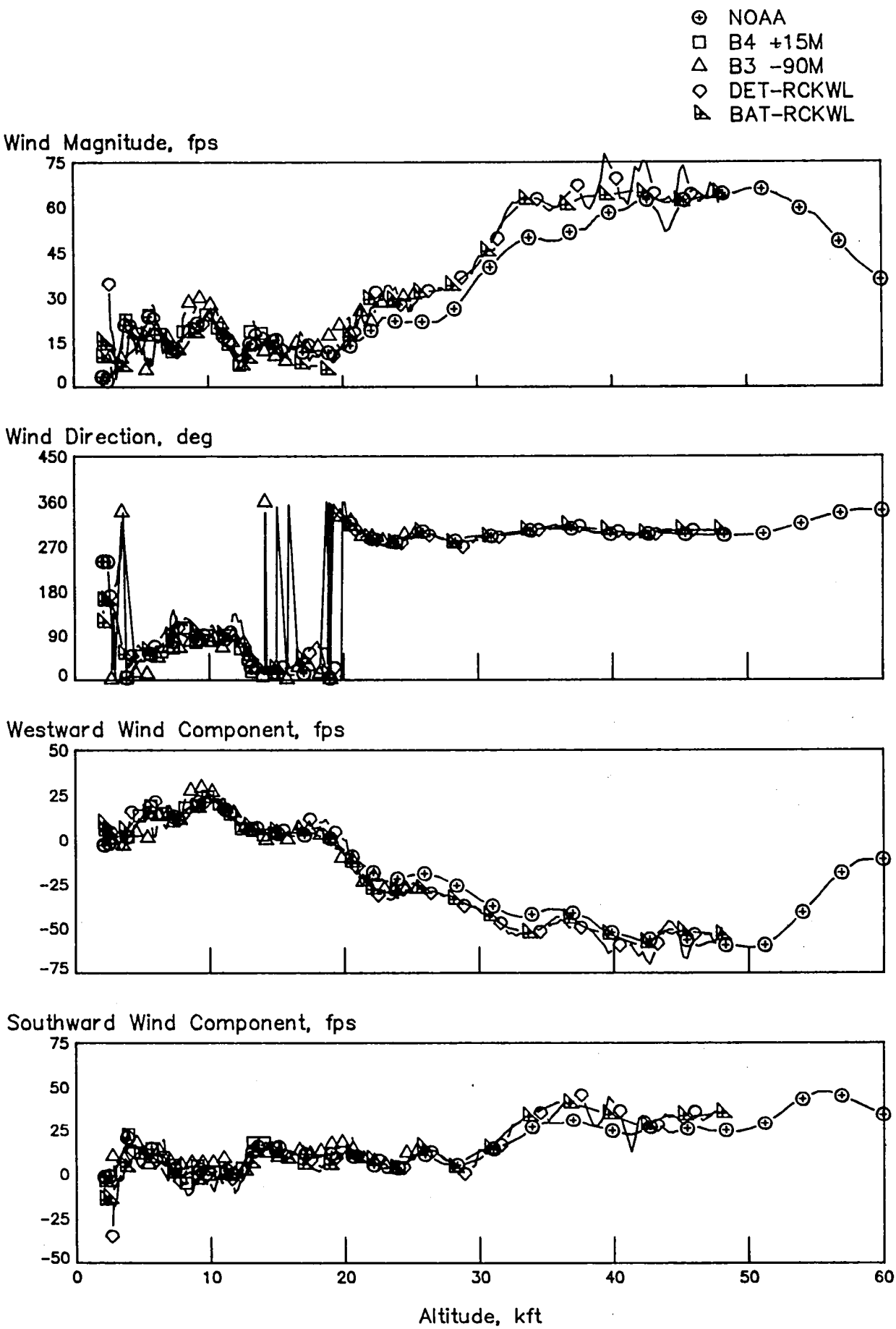


Fig.II-8. STS-13 Measured and Derived Winds

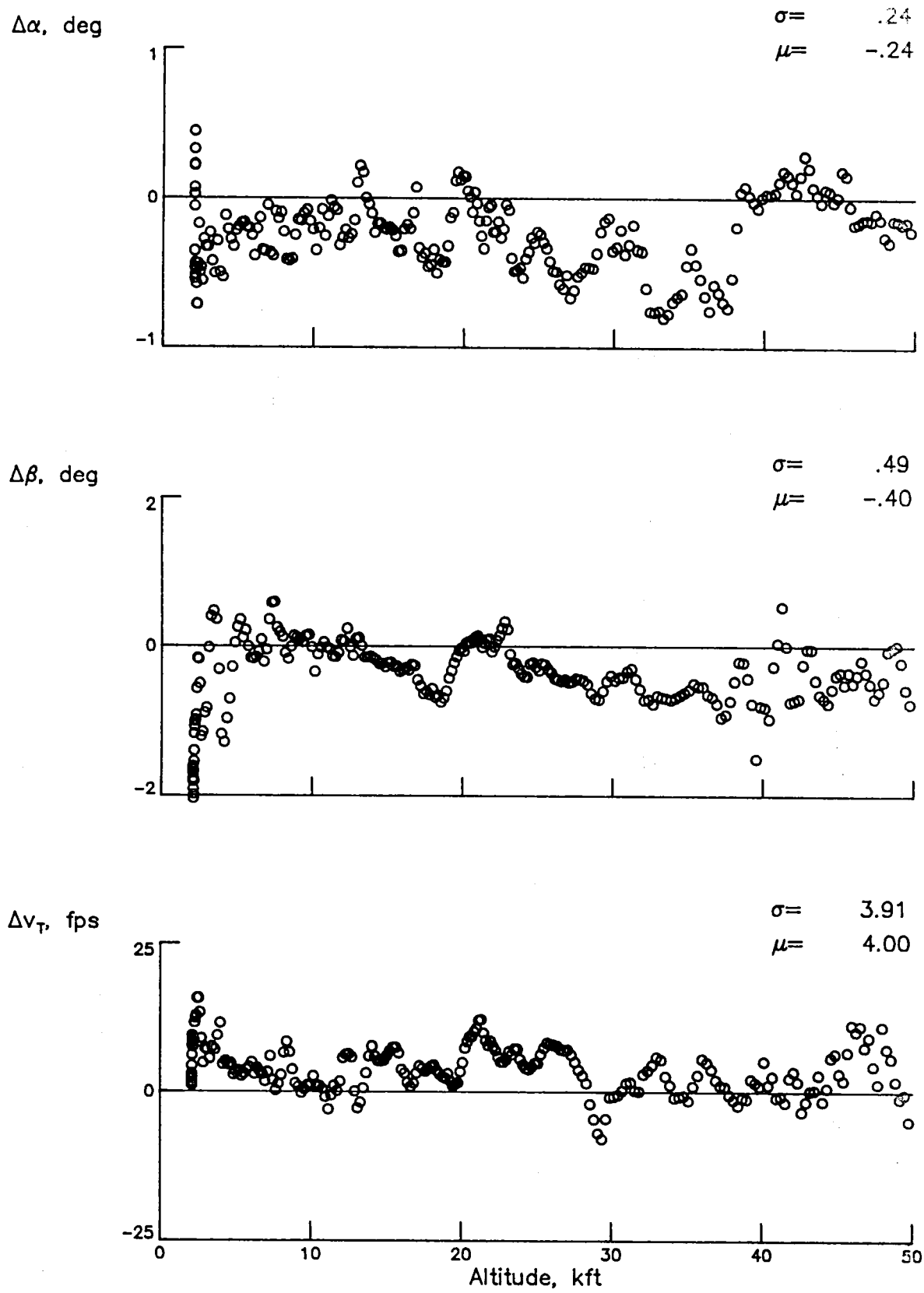


Fig. II-9. STS-13 ADP Differences, ST13ADS-ST13BET

III. Aerodynamic BET

The AEROBET was generated for STS-13 using the previously discussed Extended BET and the OI data (25 Hz source data on OI-2 (NT0831) reformatted and output at 1 Hz time synchronous with the BET on NX0683). In the time interval of $1943<t<1945$ an apparently erroneous body flap position was indicated. Apart from these channels, the remainder of the OI data were missing therein. Since the deflection implied control surface rates which are unachievable, these data were deleted. The data were held stale across this gap conforming to the ~0° deflection recorded on either side. The AEROBET output was written to nine-track reel NC0728 with a back-up (duplicate) reel provided as NC0740.

The remainder of this Section presents plots of the more important trajectory, configuration, and performance parameters from the STS-13 AEROBET. Twenty-six (26) figures are presented. Altitude versus time is presented as Figure III-1. Altitude rate, dynamic pressure, and Mach number are given versus both time and altitude as Figures III-2, III-3, and III-4, respectively. V_{bar_∞} versus altitude is presented as Figure III-5. Air relative attitude angles (angle-of-attack, α; side-slip angle, β; and roll angle, σ) are shown versus time, Mach, and altitude in the next three figures. The plot versus Mach number (Figure III-7) shows a shaded region of α ranges determined by the previous ten(10) Shuttle flights as information for comparison.

Spacecraft dynamics (body rates and accelerations derived from IMU2 measurements) are next given versus Mach (Figure III-9) and altitude (Figure III-10). Plots of these parameters versus time were presented in Section I of this report. It is noted that the dynamic data plot versus altitude (Figure III-10) only covers the lowermost 400 kft.

Control surface deflection profiles are presented versus time, Mach, and altitude as Figures III-11 through III-13, respectively. Again, for comparison purposes and to facilitate future analyses, the plots versus Mach number show (as shaded regions) the range of longitudinal control effectors generated over the first ten flights. Some additional positive (downward) elevon and positive (downward) body flap opportunities are suggested thereon.

To complete the configuration plots presented, Figure III-14 through III-16 are given which show RCS activity versus time, Mach, and altitude for STS-13.

Performance comparisons are next presented. Flight and predicted parameters (with ± variations superimposed about the predicts) are presented. Results are presented versus Mach number ($2<M<30$) for L/D (Figure III-17a), C_L (Figure III-19a), C_D (Figure III-21a) and pitching moment (Figure III-25 at the flight c.g.). Expanded plots versus Mach number ($M<2$) for L/D, C_L, and C_D are given as Figure III-17b, Figure III-19b, and Figure III-21b, respectively. Figures III-18 a and b are L/D plots versus altitude conforming to the same two Mach ranges. Similarly, C_L and C_D comparisons versus altitude are presented as Figures III-20 (a and b) and Figures III-22 (a and b).

Percentage equivalents of the performance comparisons previously discussed are given as Figures III-23 (a and b) versus Mach number and Figures III-24 (a and b) versus altitude. Again, the Mach plots have superimposed thereon ensemble statistics representative of the first ten flight experience. No major differences are suggested by the STS-13 results. The percentage equivalent of the pitching moment difference curve is given in Figure III-26. Here, the percentage difference is referenced to the 65 percent X/L c.g. commensurate with the data base.

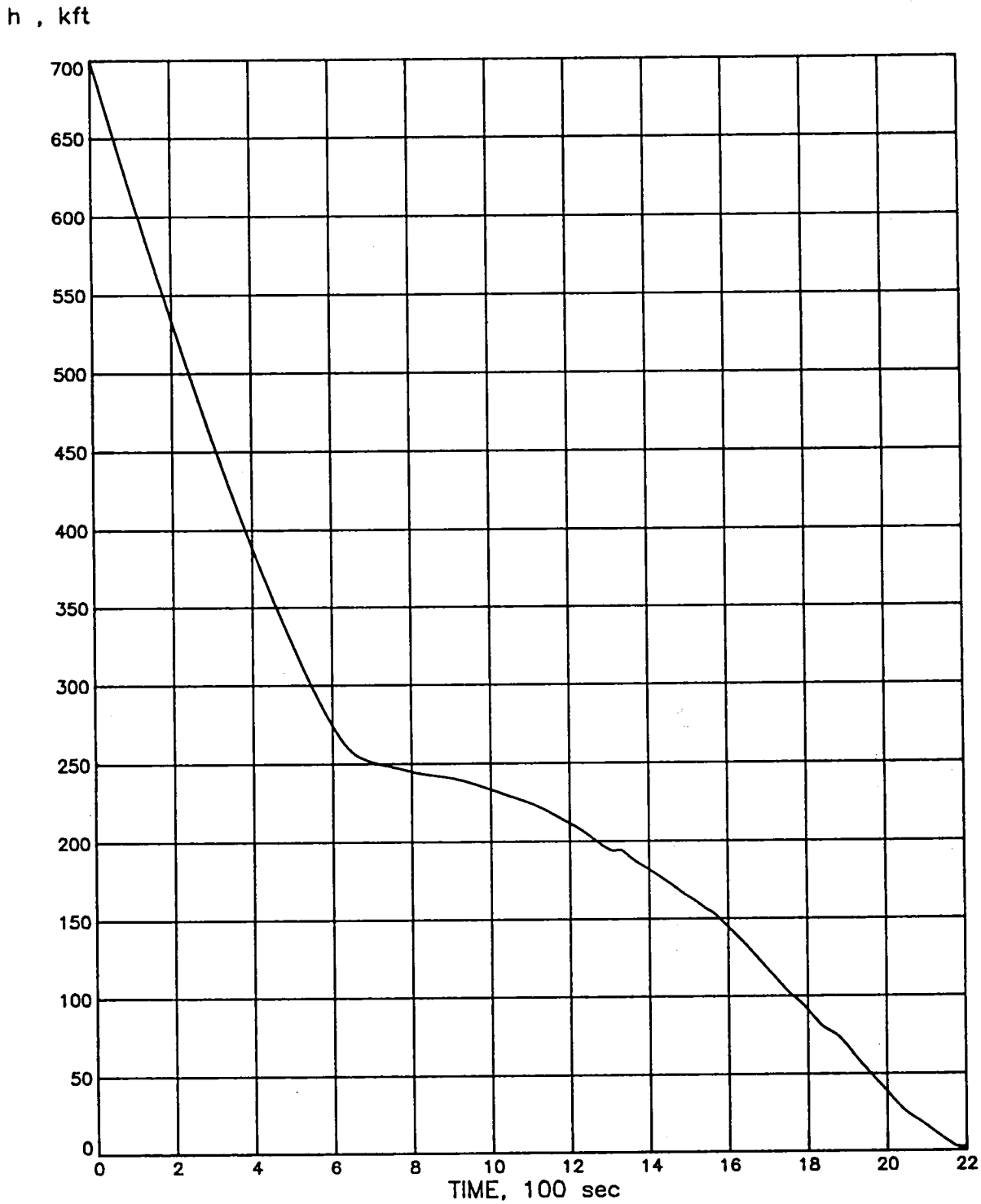
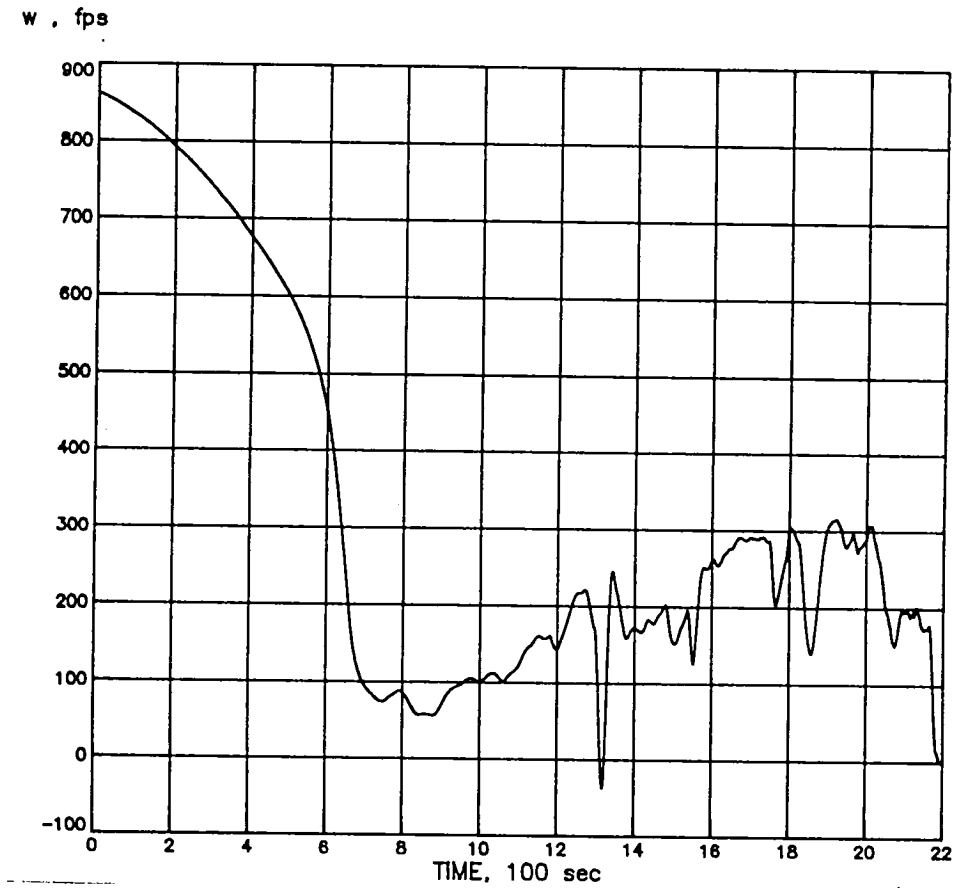


Figure III-1. STS-13 altitude time history



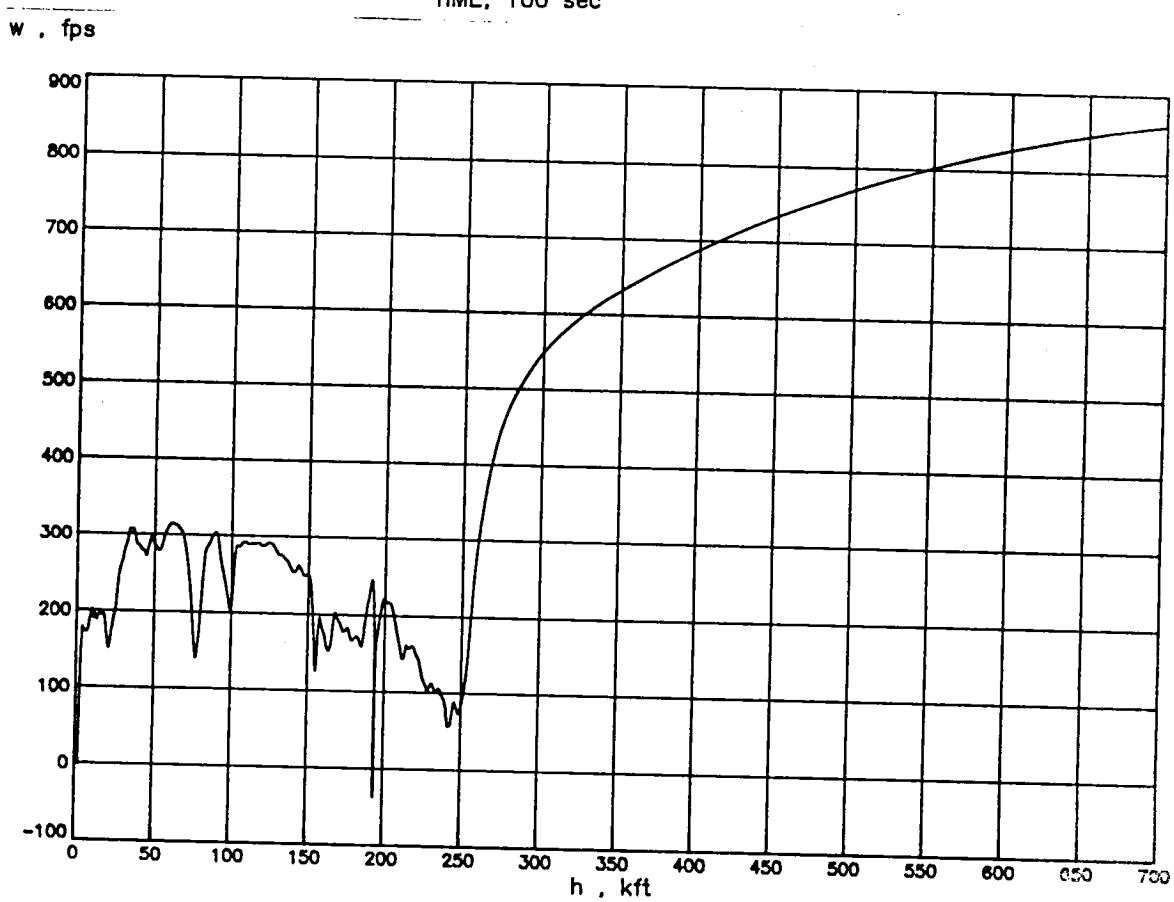
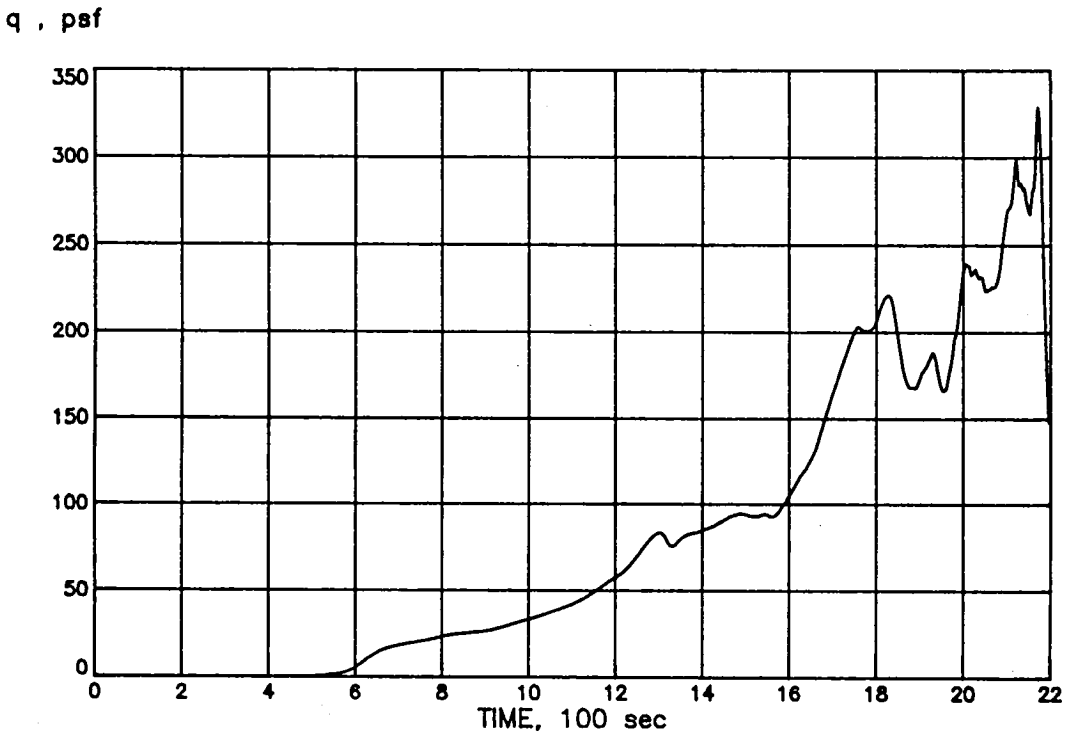


Figure III-2. STS-13 descent rate versus time and altitude ($\dot{h} = -w$)



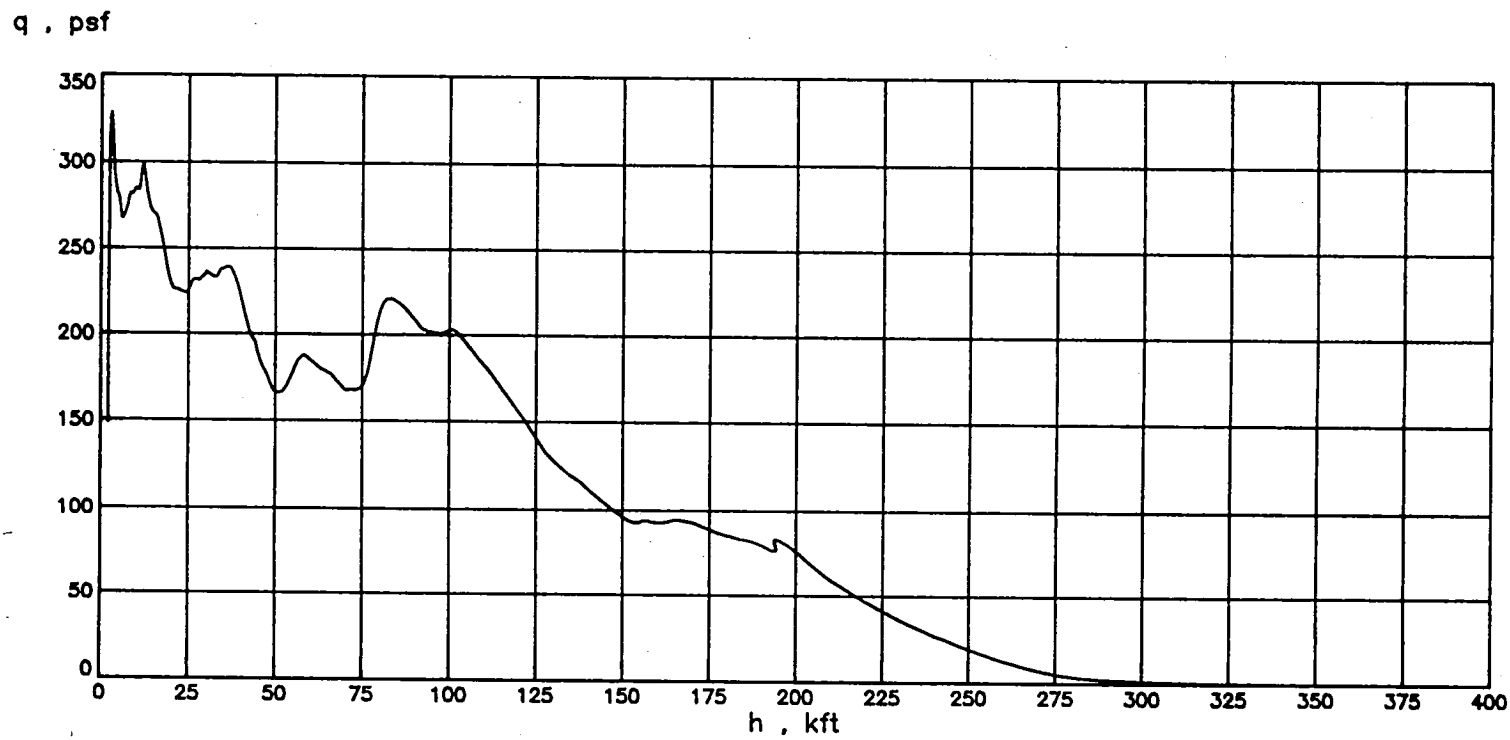
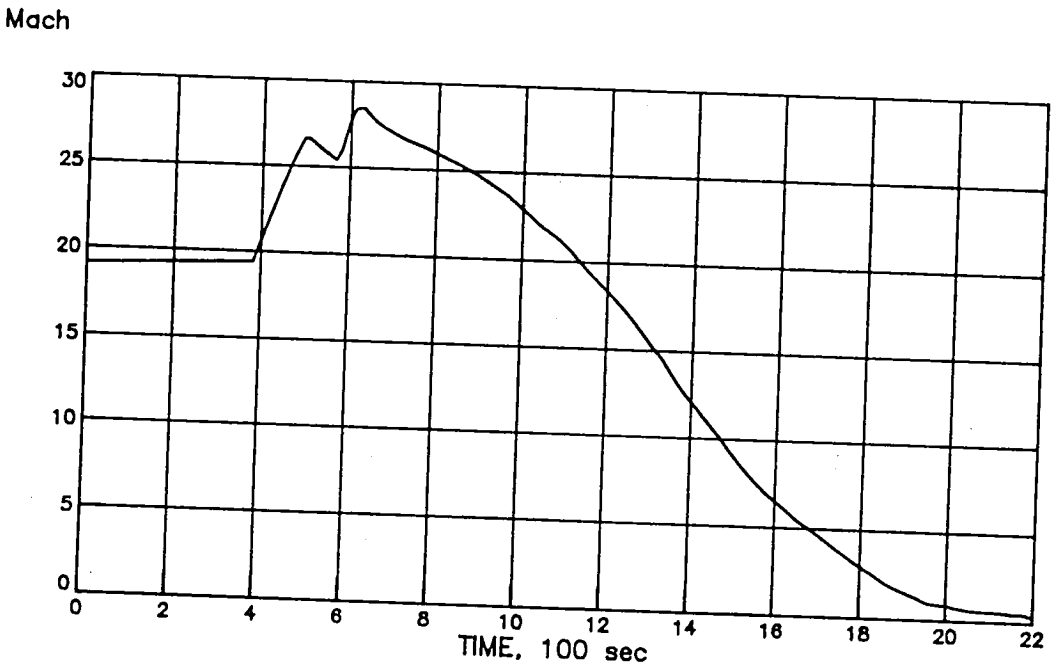


Figure III-3. STS-13 dynamic pressure vs. time and altitude



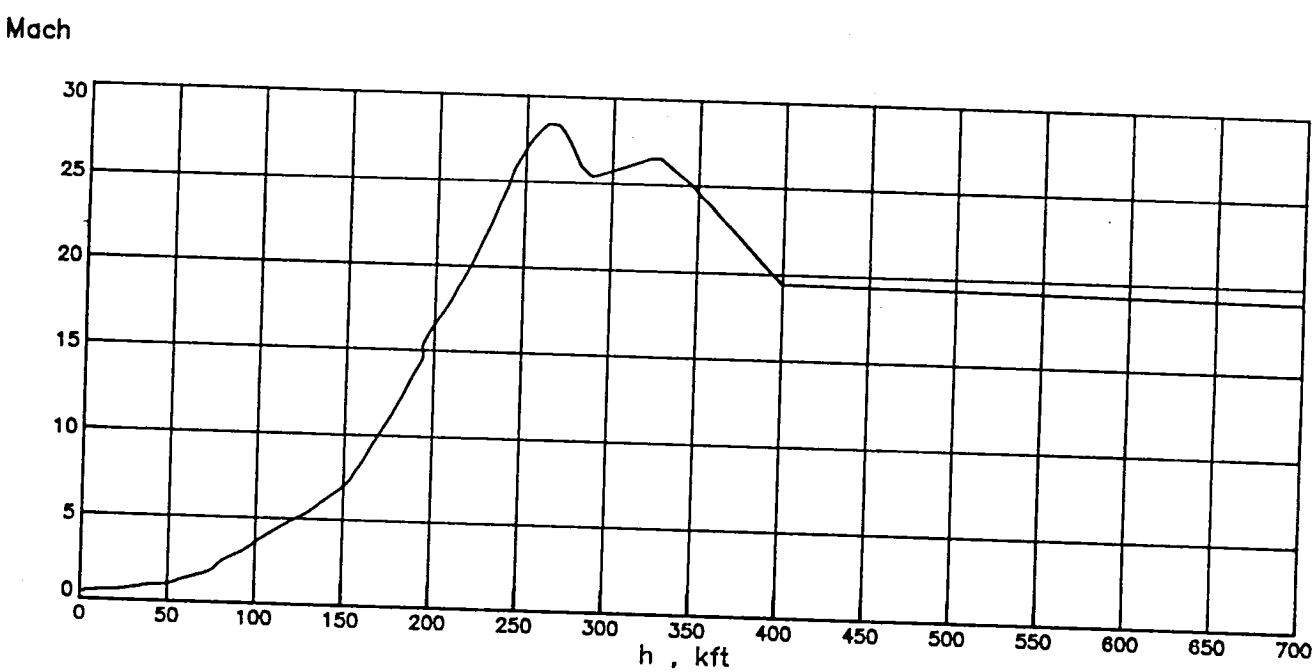


Figure III-4. STS-13 Mach number versus time and altitude

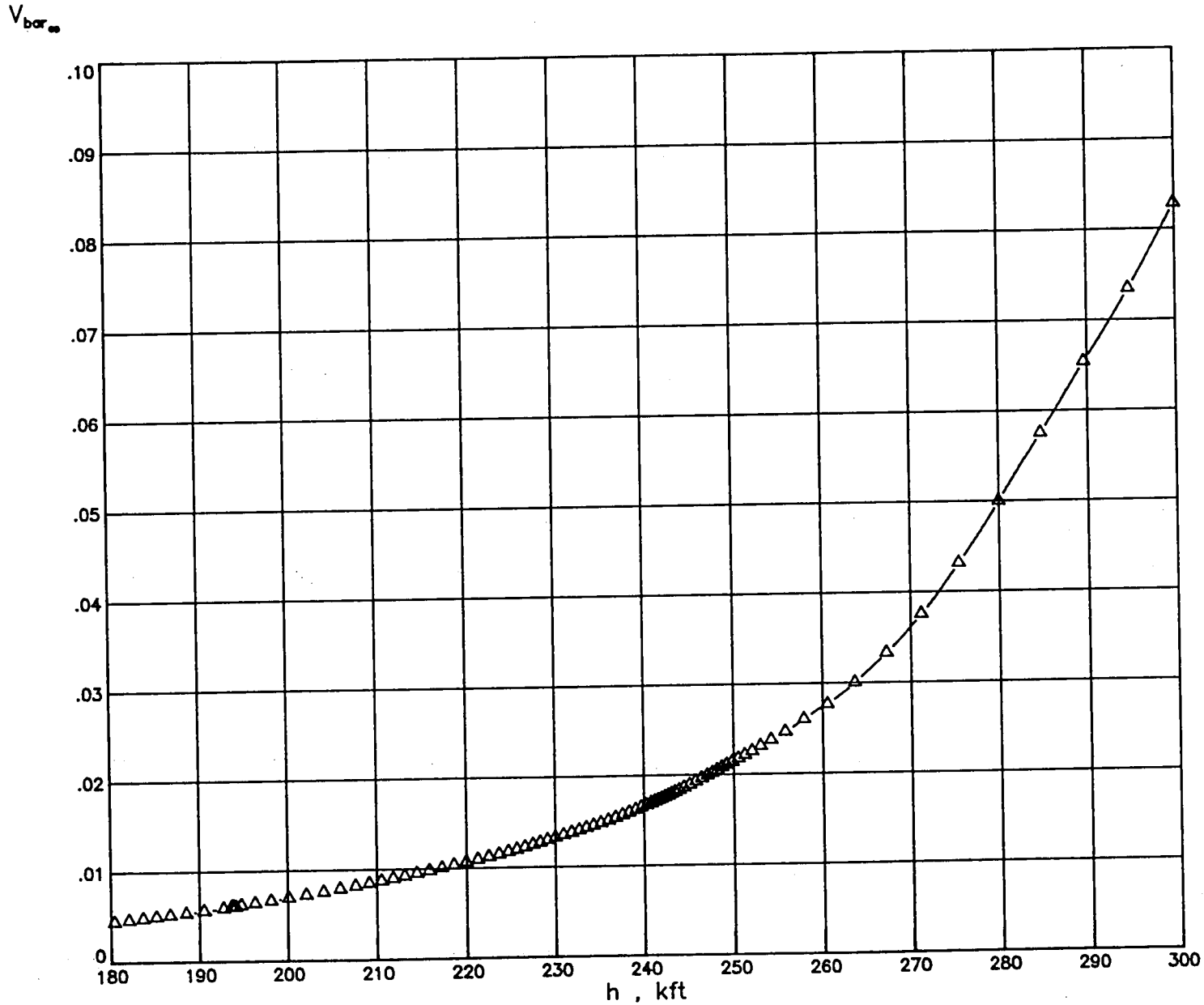


Figure III-5. STS-13 Vbar versus altitude

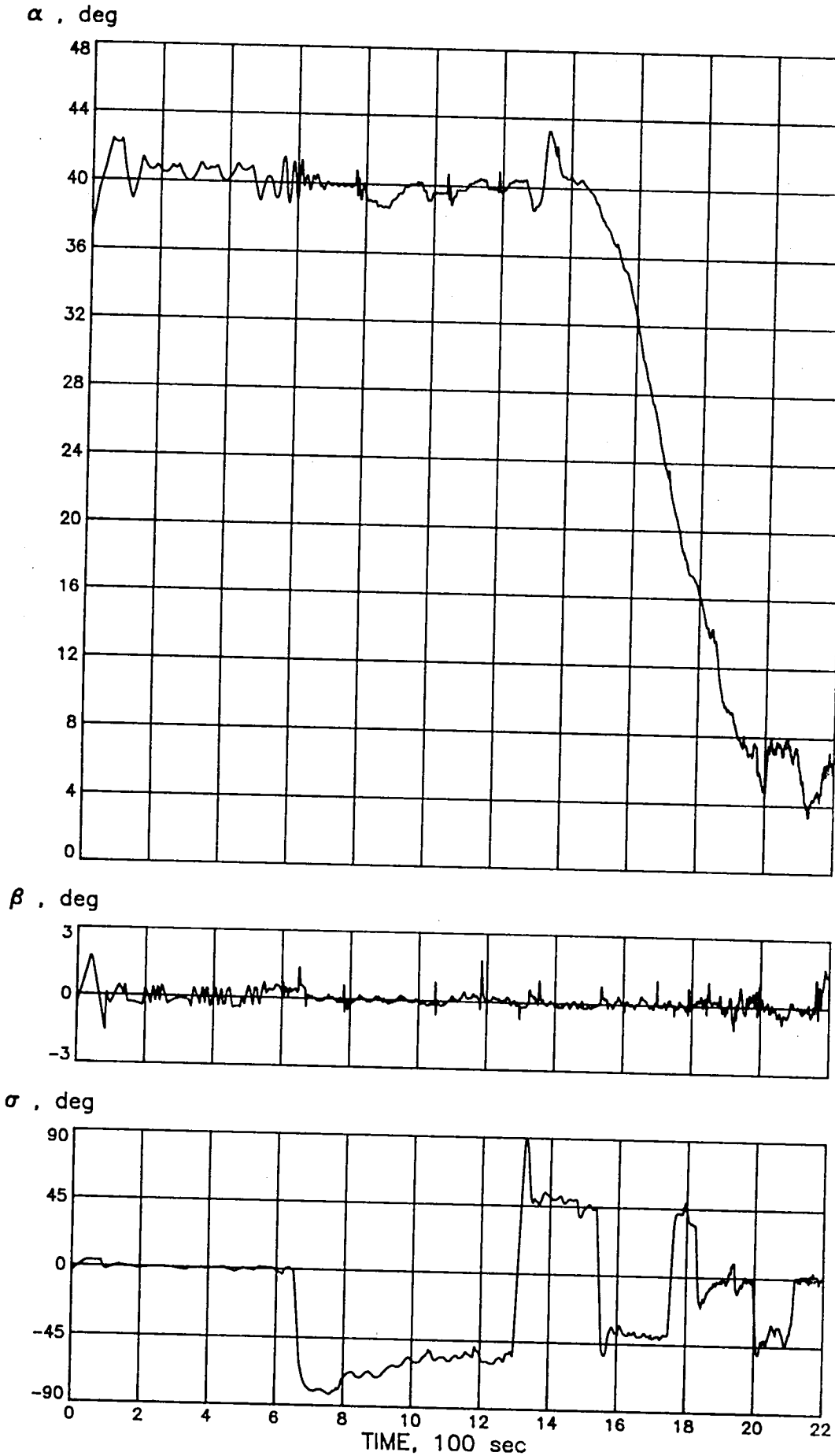


Figure III-6. STS-13 α, β and σ vs. time

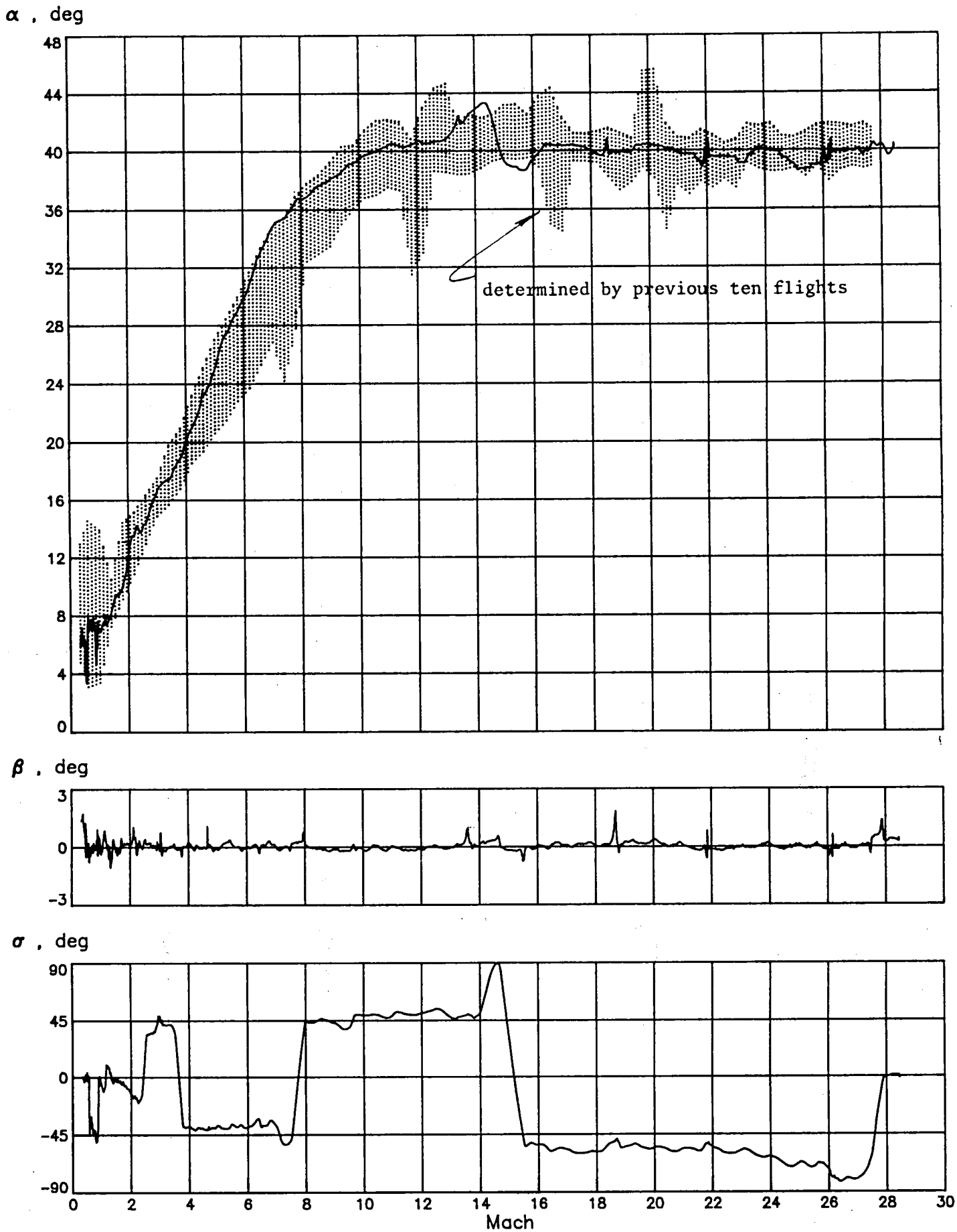


Figure III-7. STS-13 α, β and σ vs. Mach

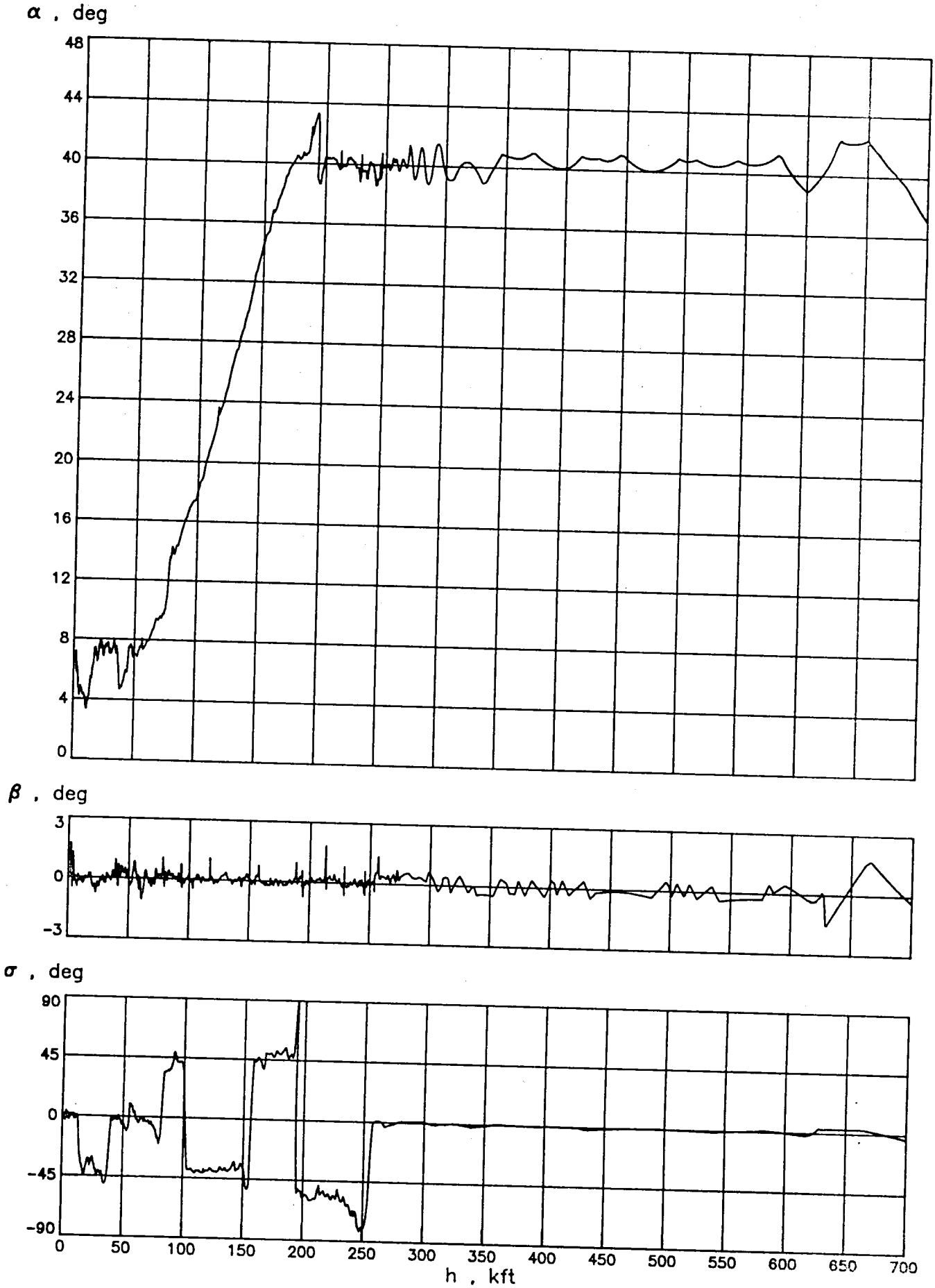


Figure III-8. STS-13 α, β and σ vs. h

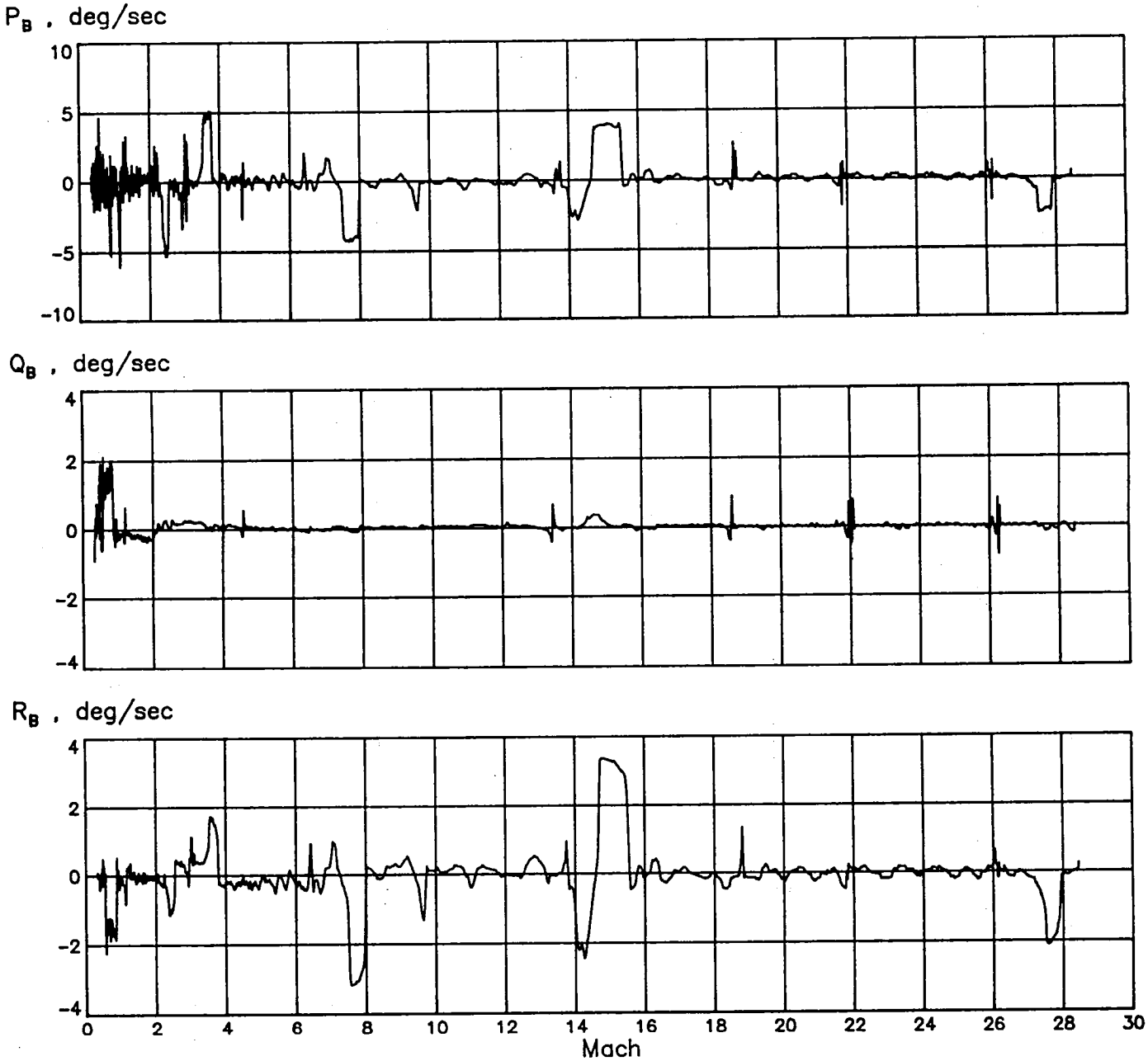


Figure III-9. STS-13 dynamic data vs. Mach

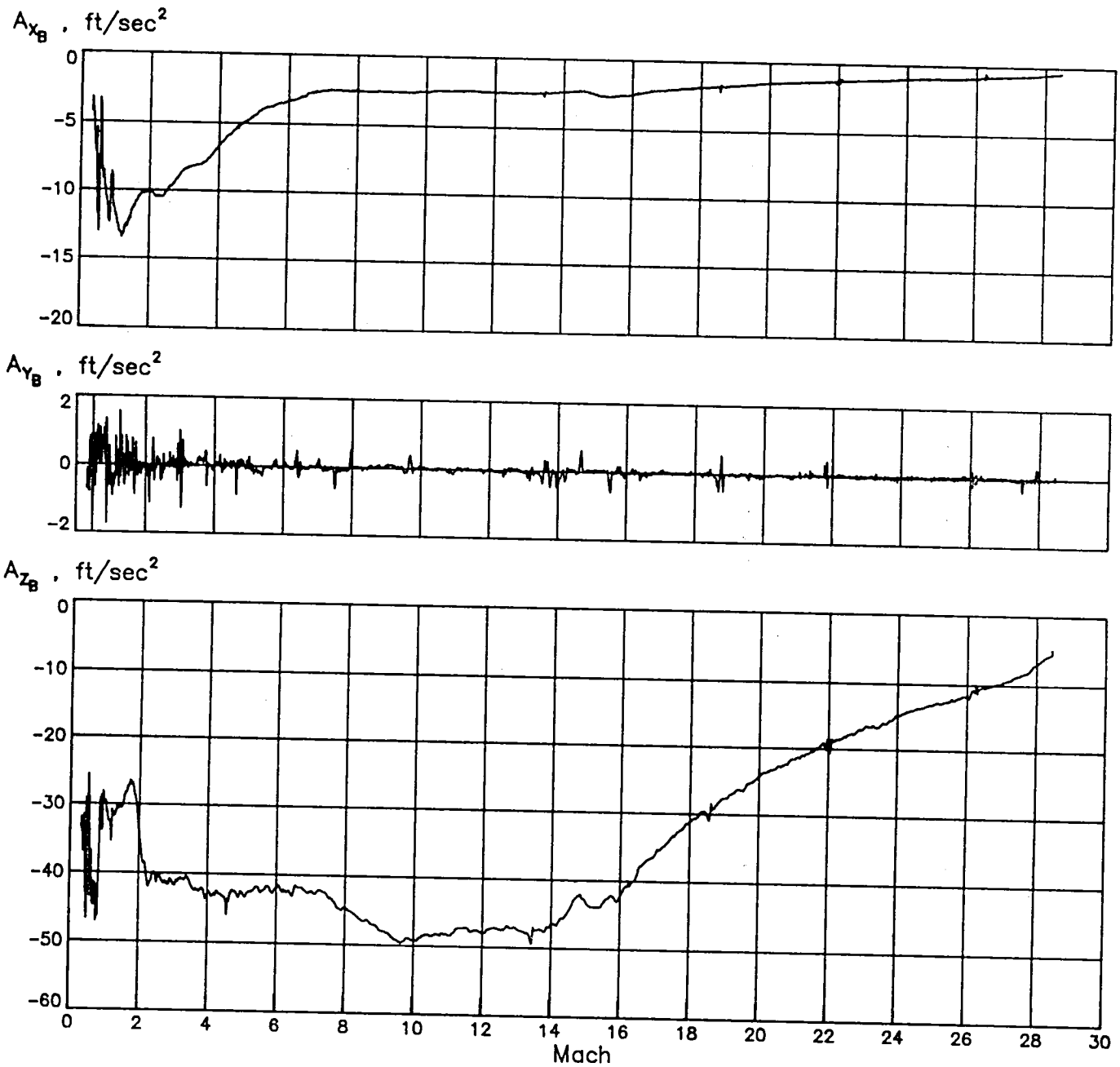


Figure III-9. (concluded)

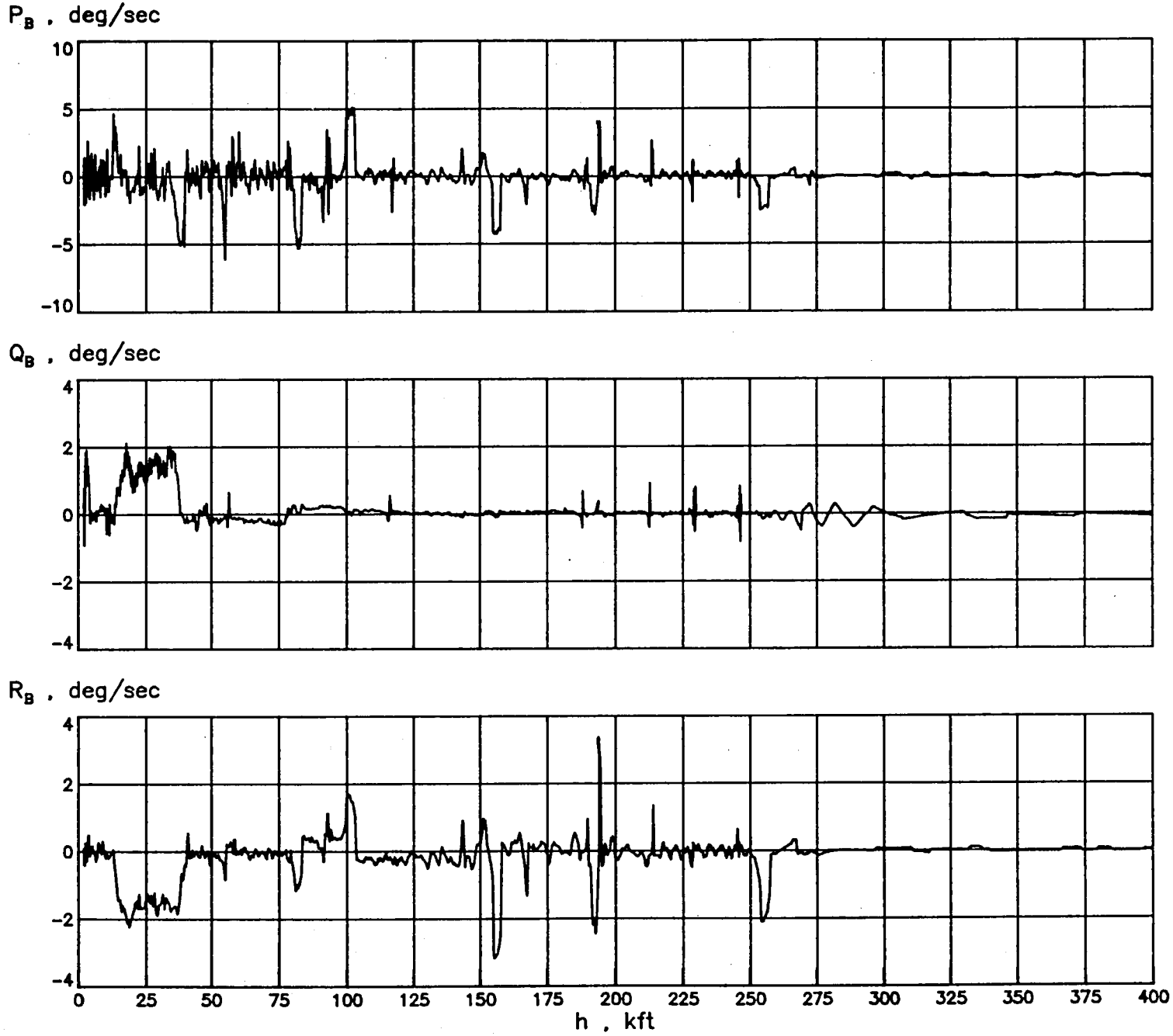


Figure III-10. STS-13 dynamic data vs. altitude

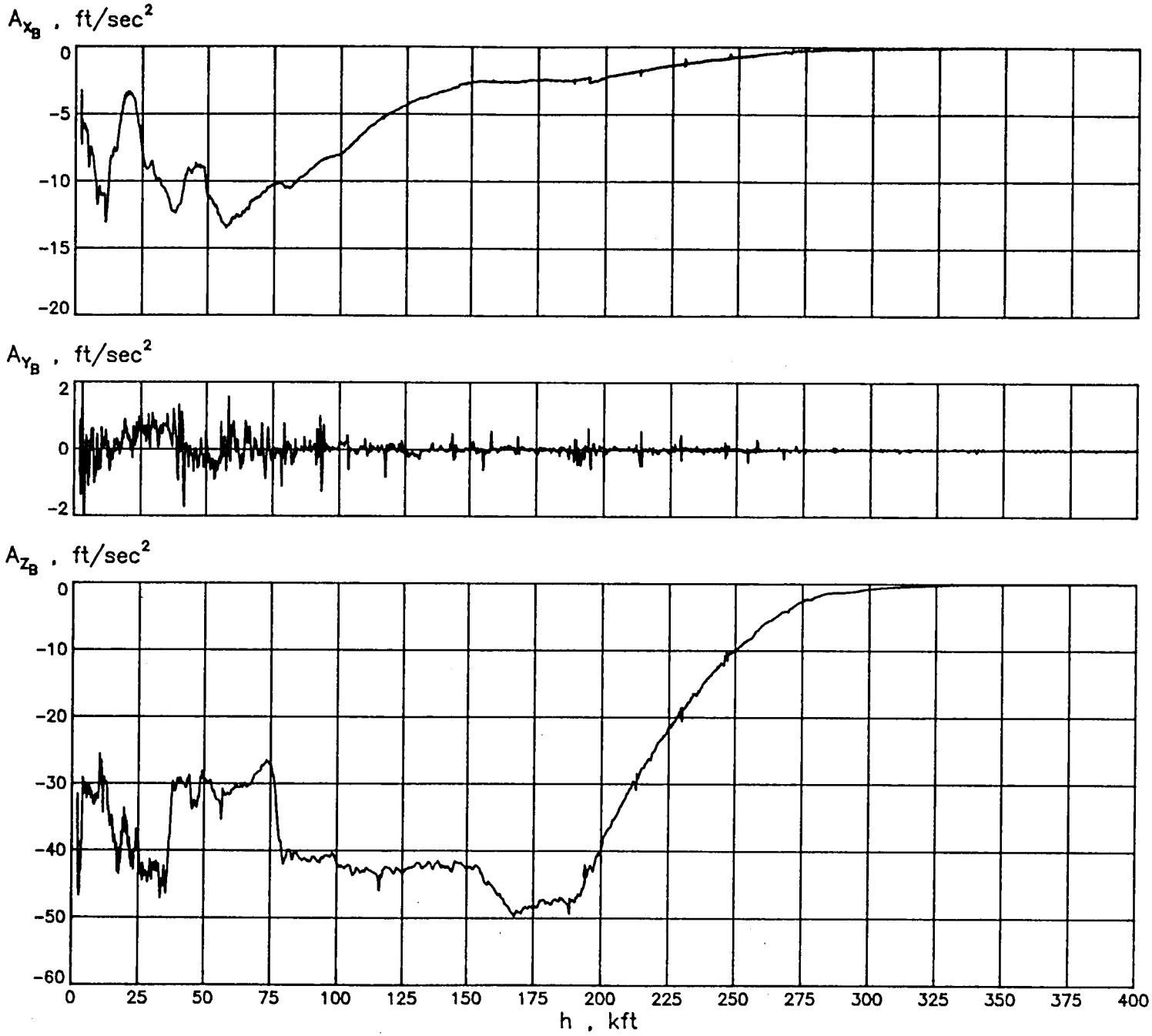


Figure III-10. (CONCLUDED)

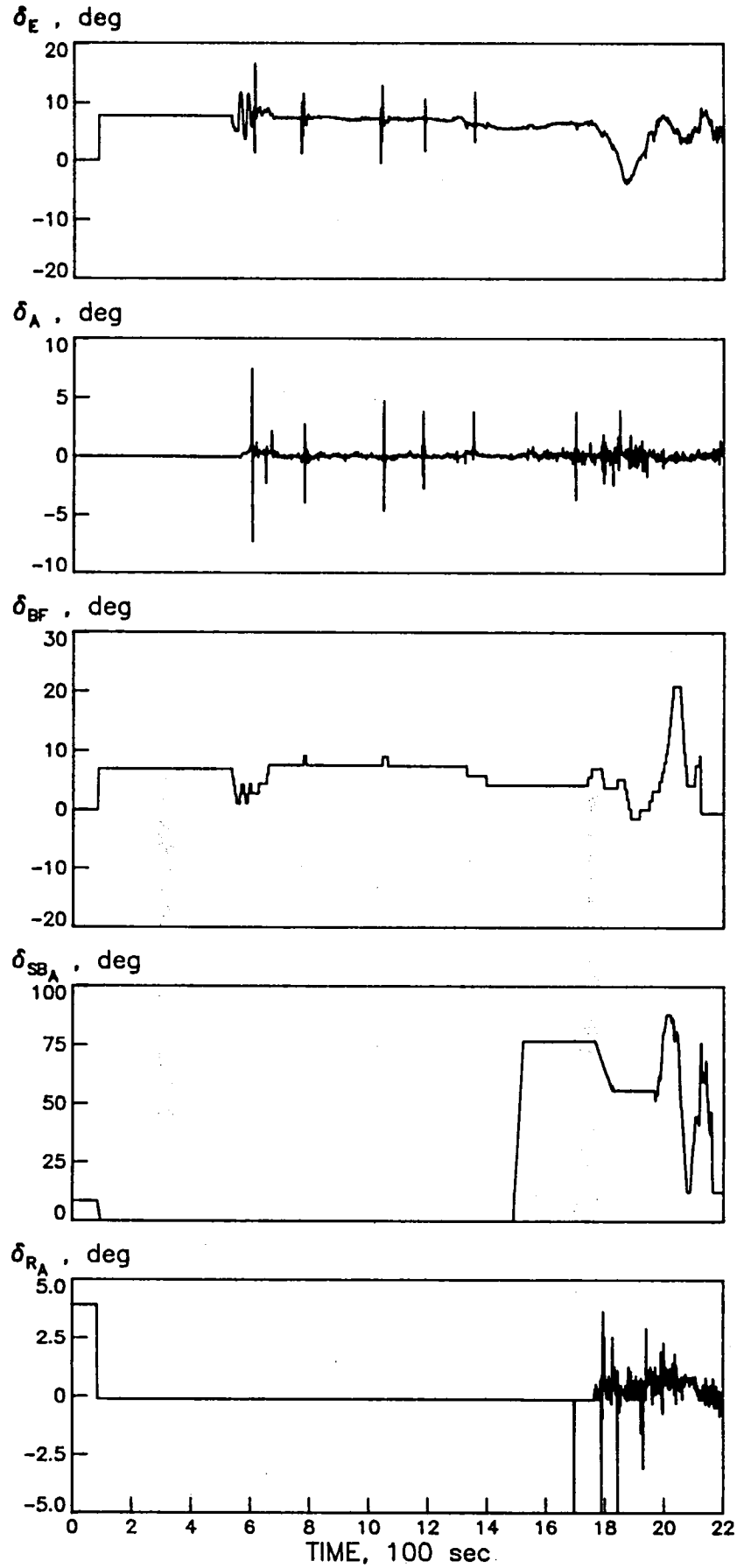


Figure III-11. STS-13 control surfaces vs. time

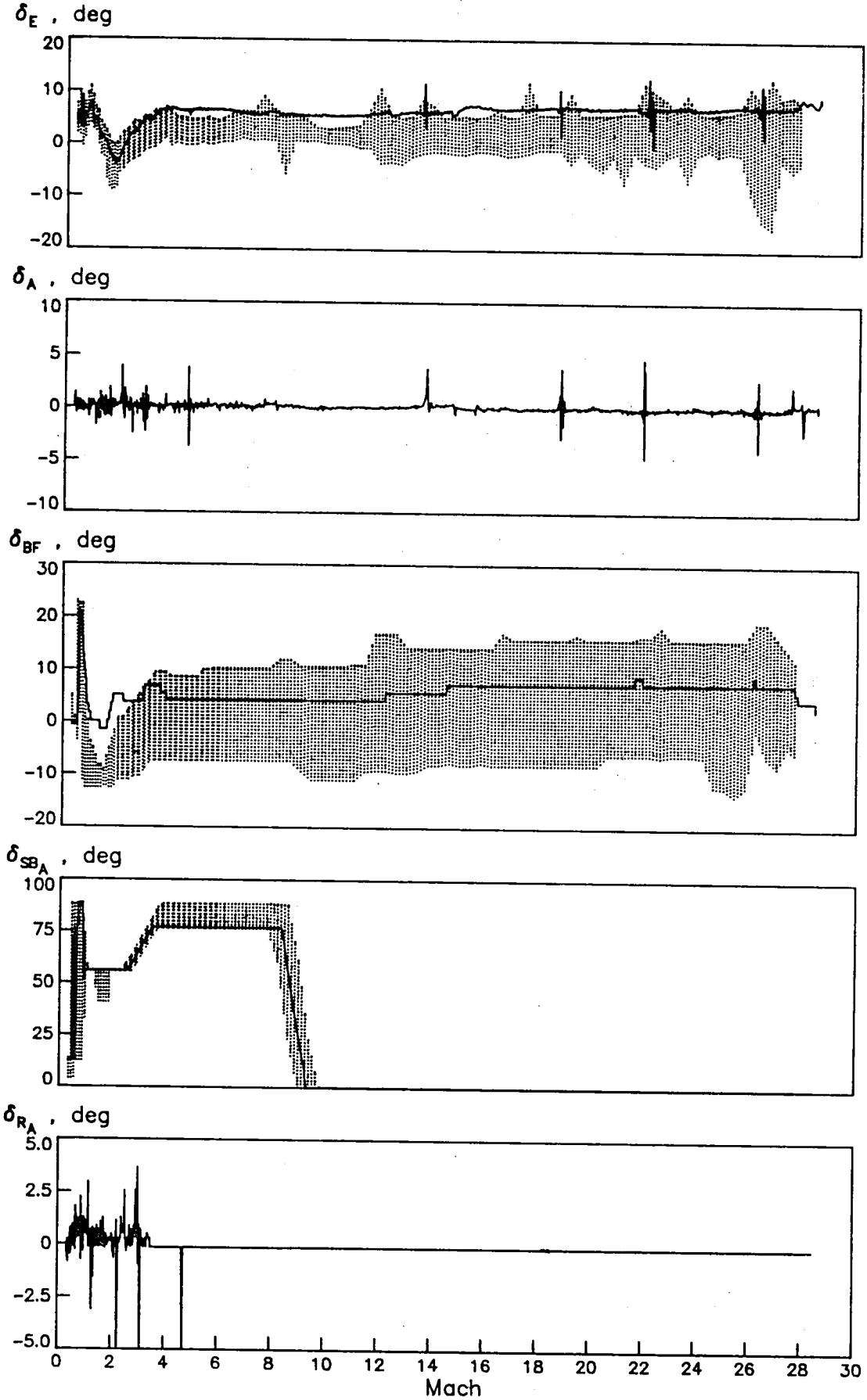


Figure III-12. STS-13 control surfaces vs. Mach
(shaded region defined by previous ten flights)

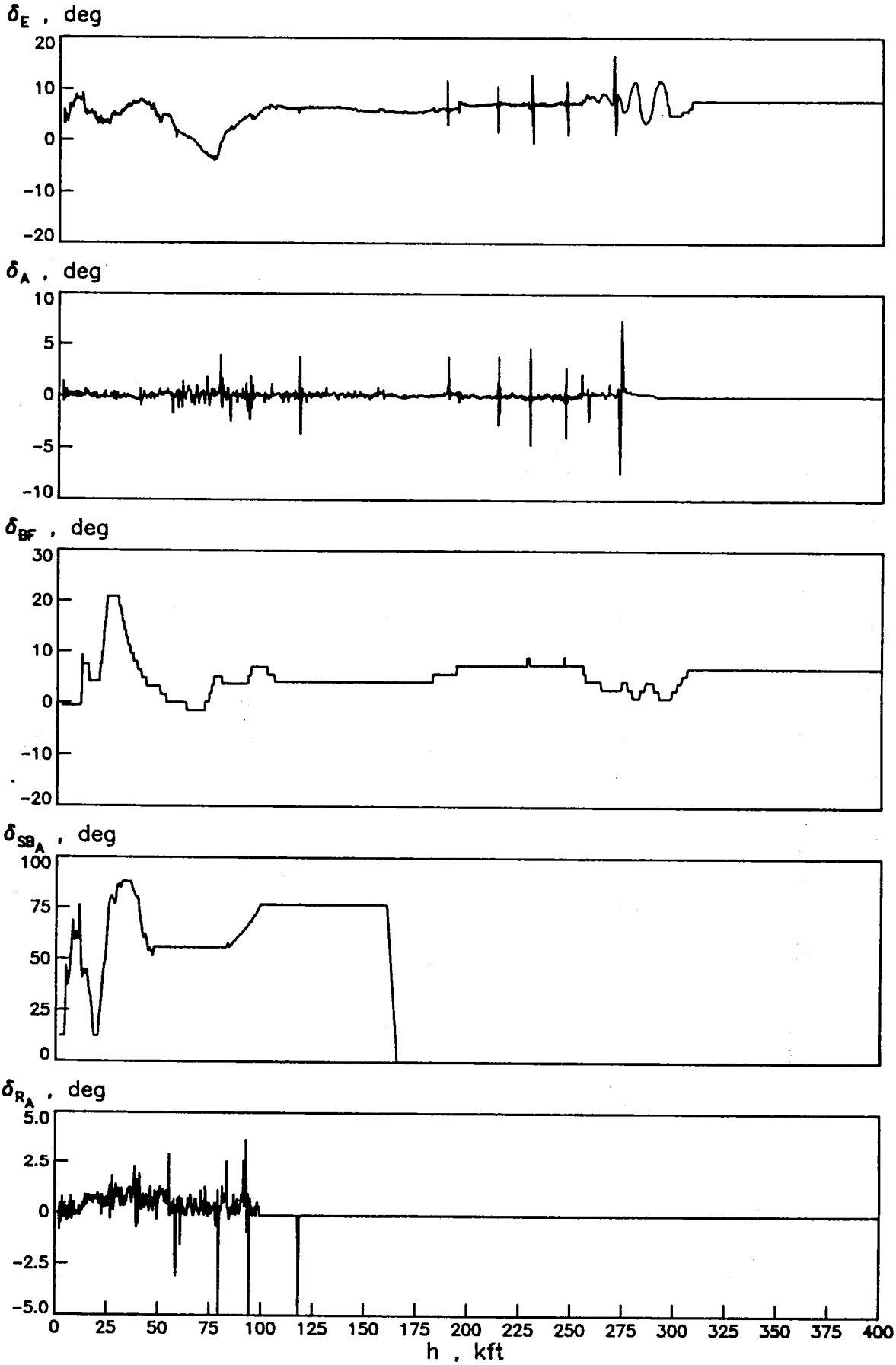


Figure III-13. STS-13 control surfaces vs. altitude

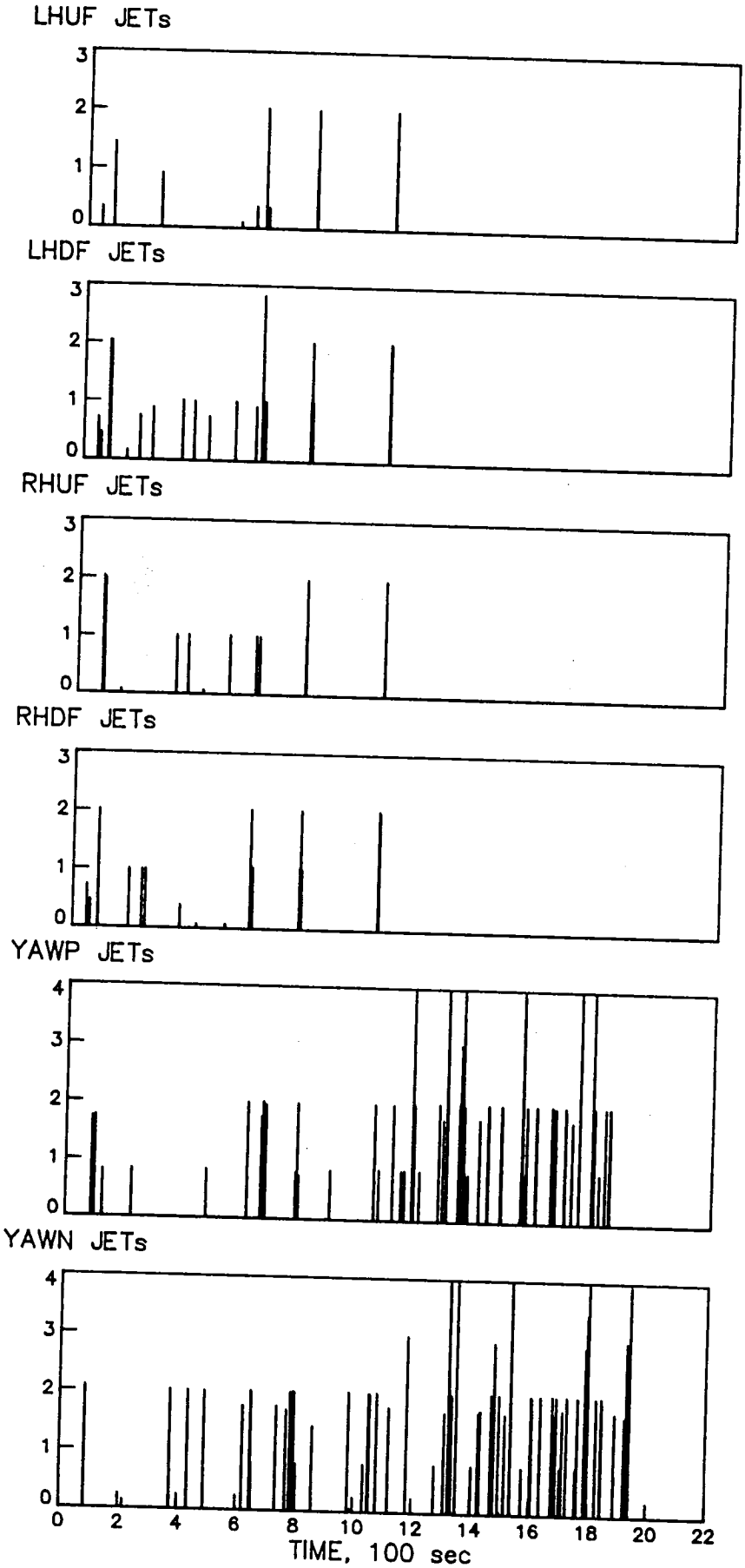


Figure III-14. STS-13 RCS firings vs. time

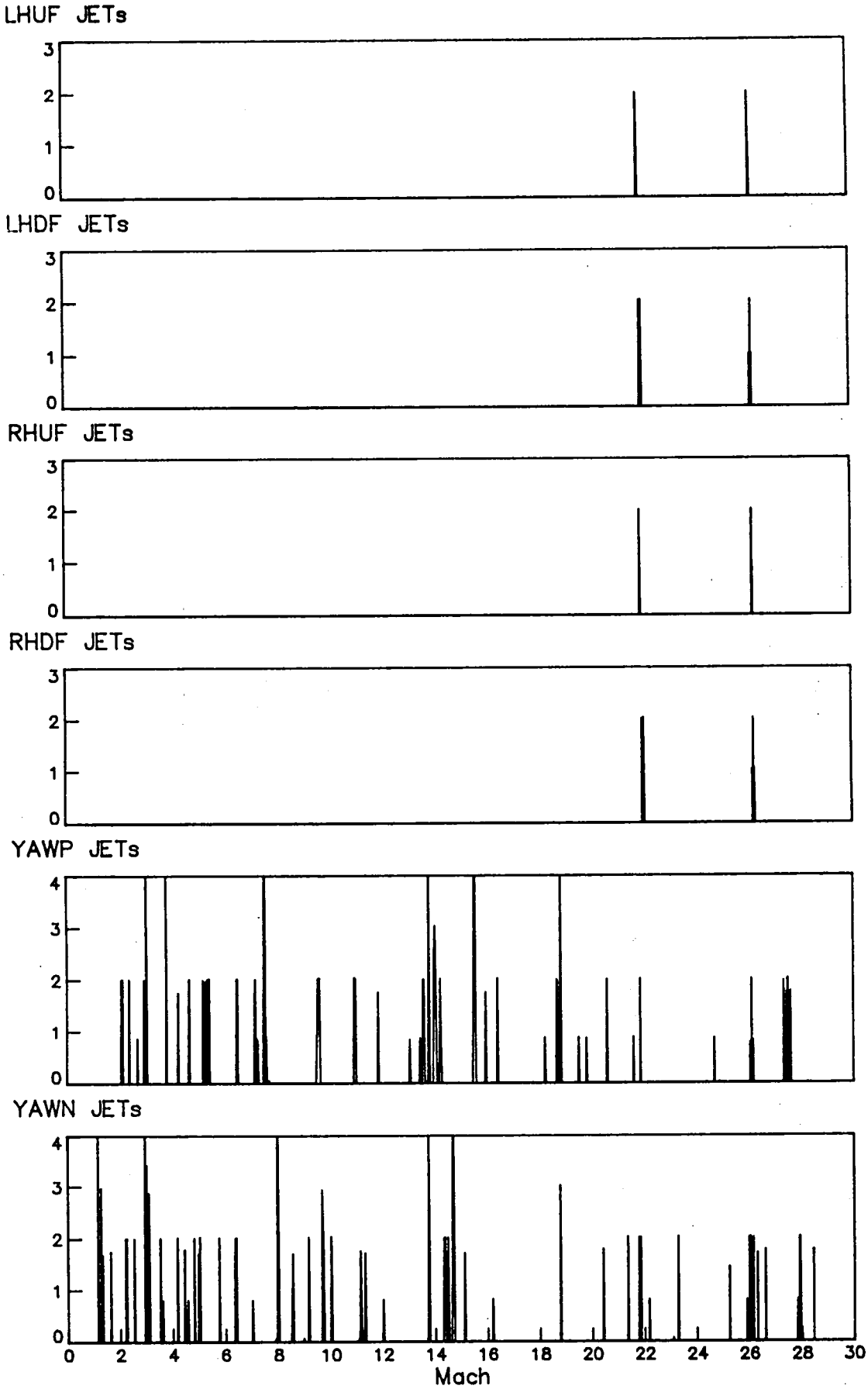


Figure III-15. STS-13 RCS firings vs. Mach

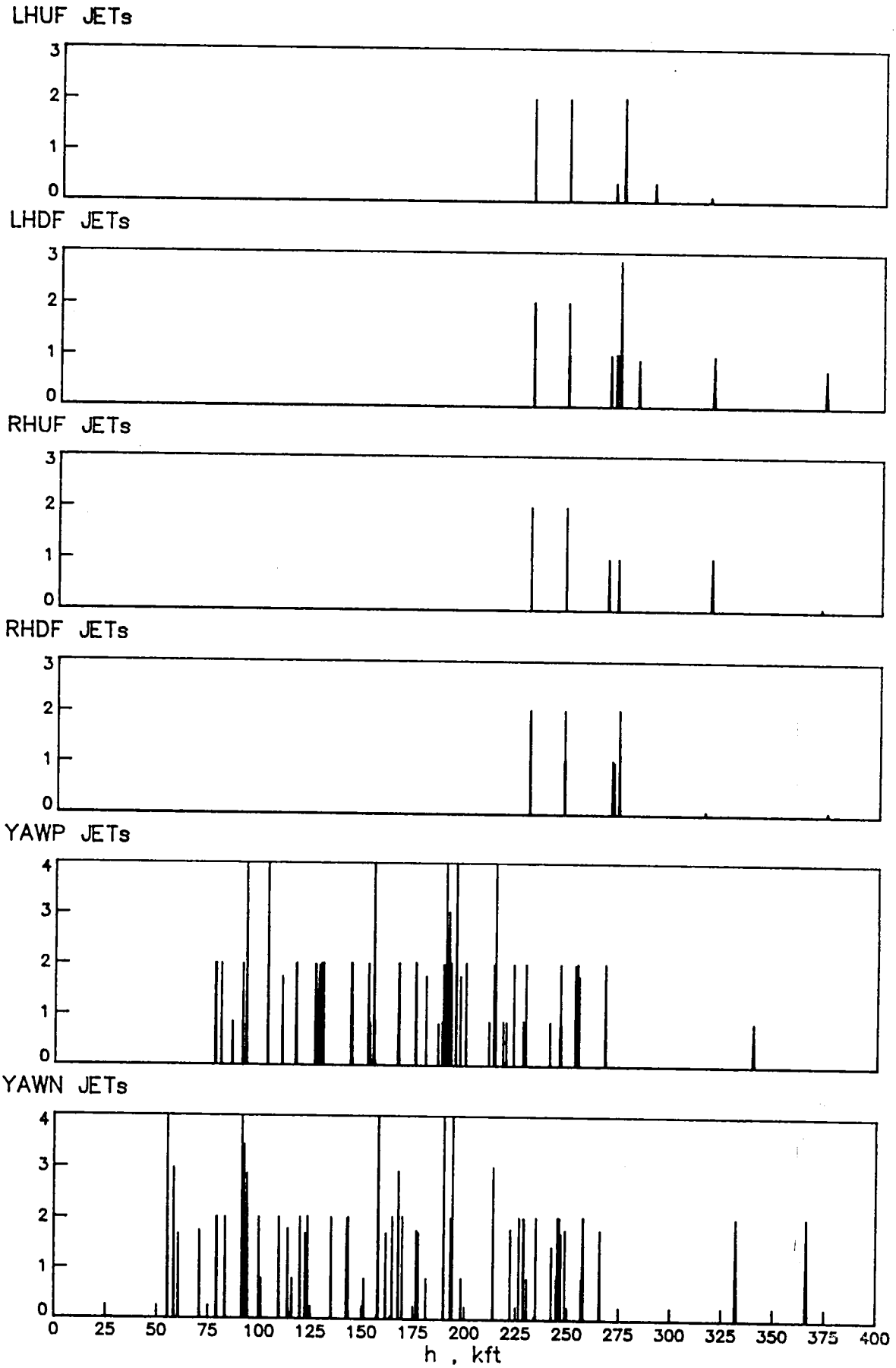


Figure III-16. STS-13 RCS firings vs. altitude

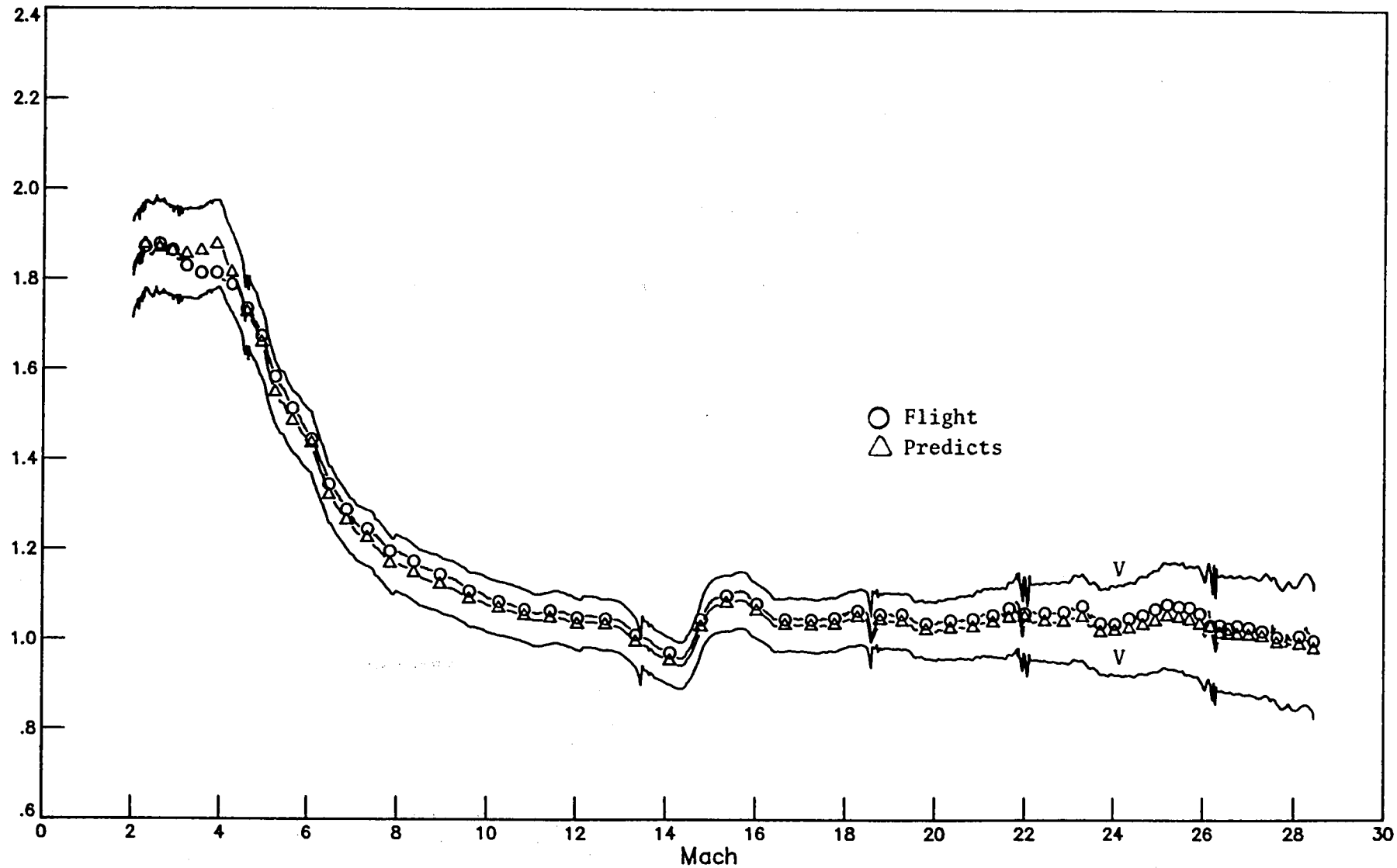


Figure III-17a. STS-13 L/D comparisons vs. Mach

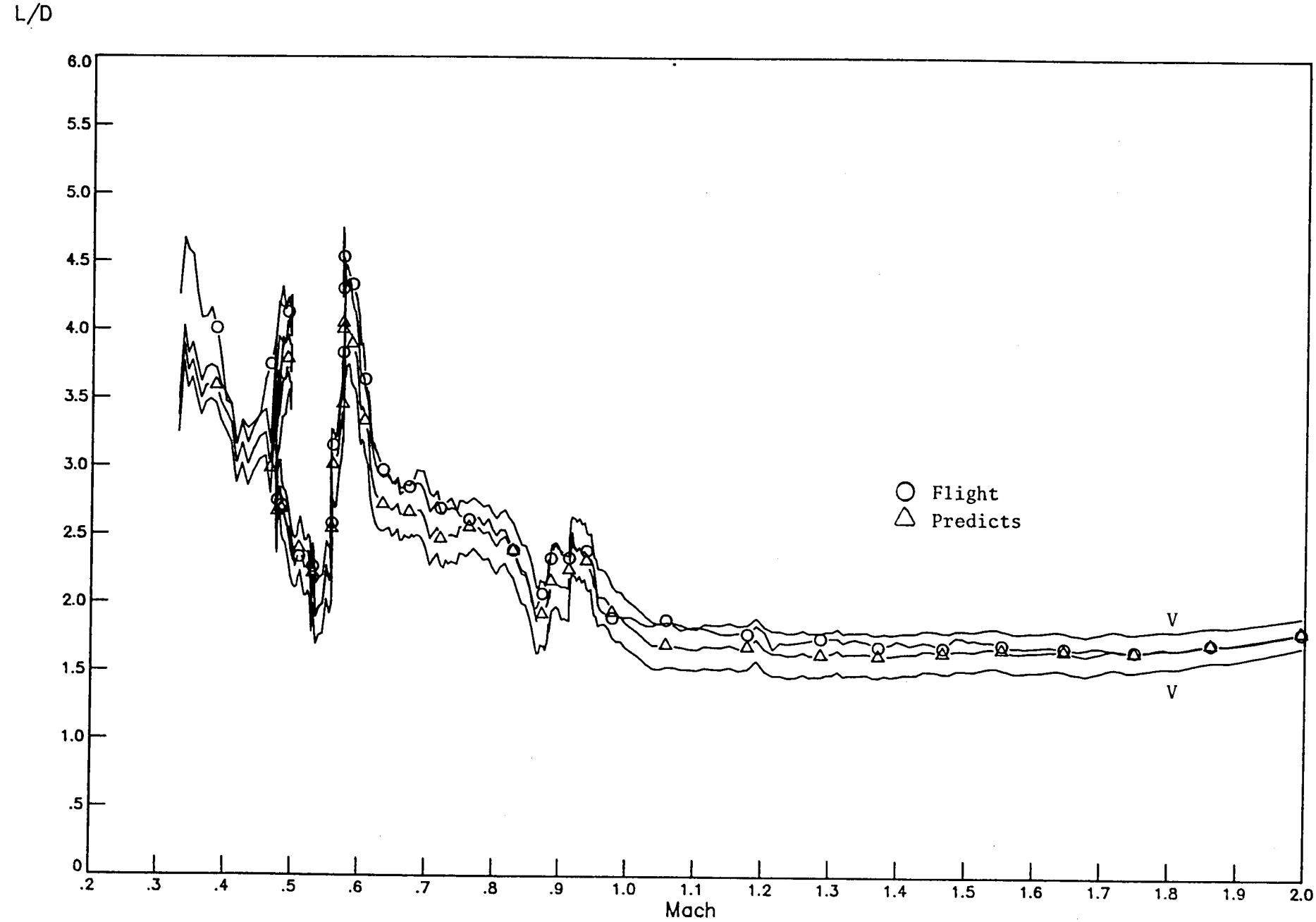


Figure III-17b. STS-13 L/D comparisons vs. Mach

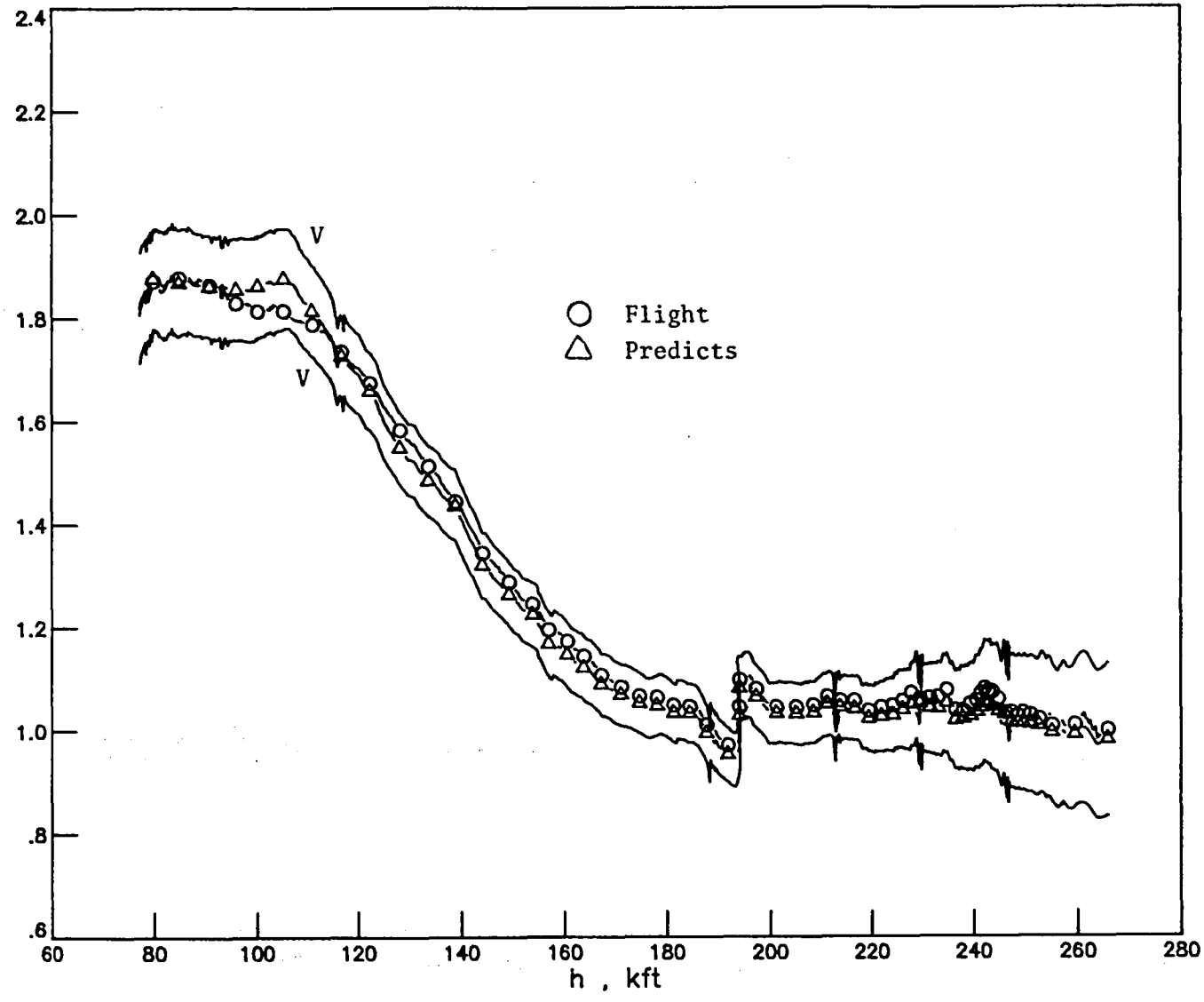


Figure III-18a. STS-13 L/D comparisons vs. altitude

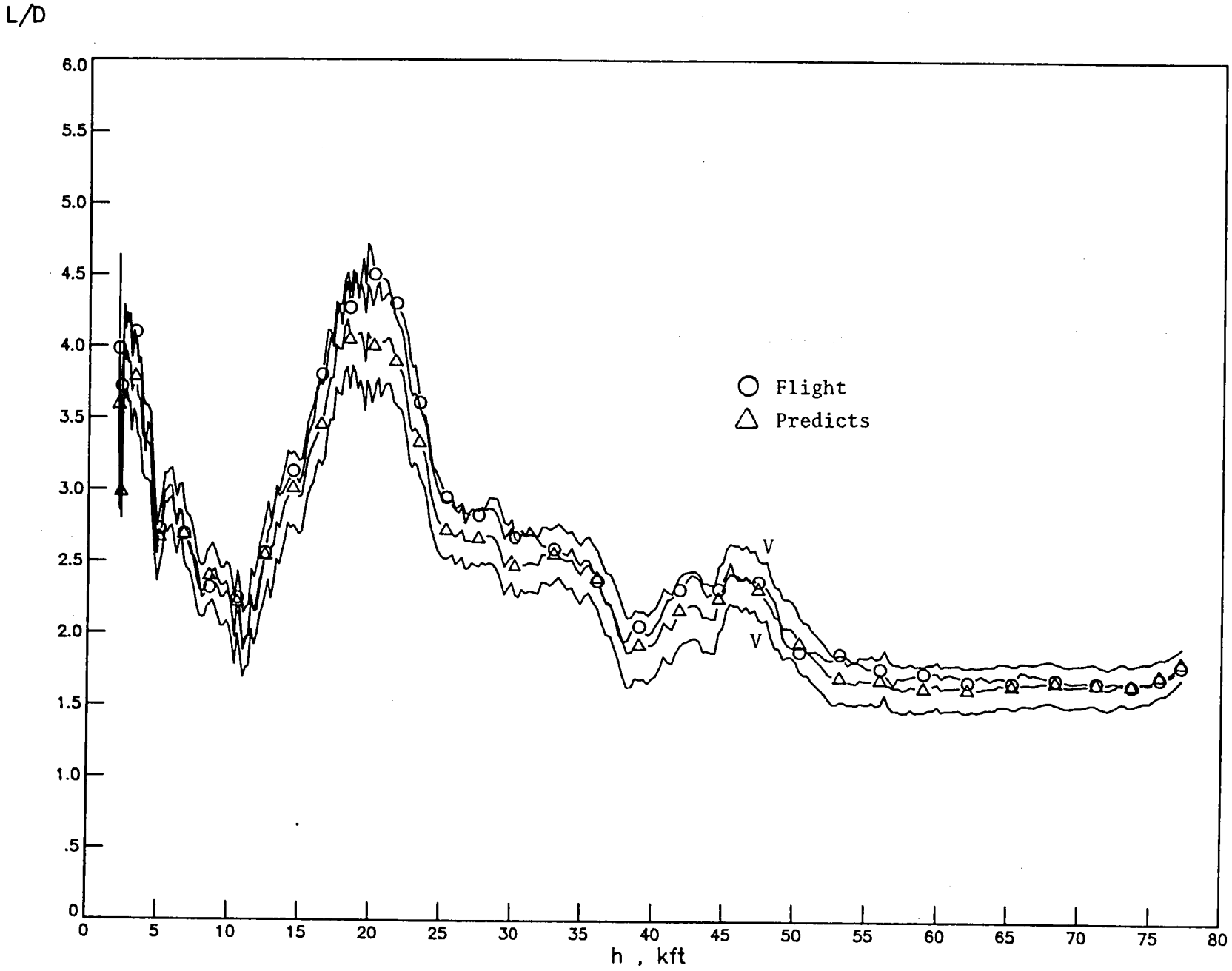


Figure III-18b. STS-13 L/D comparisons vs. altitude

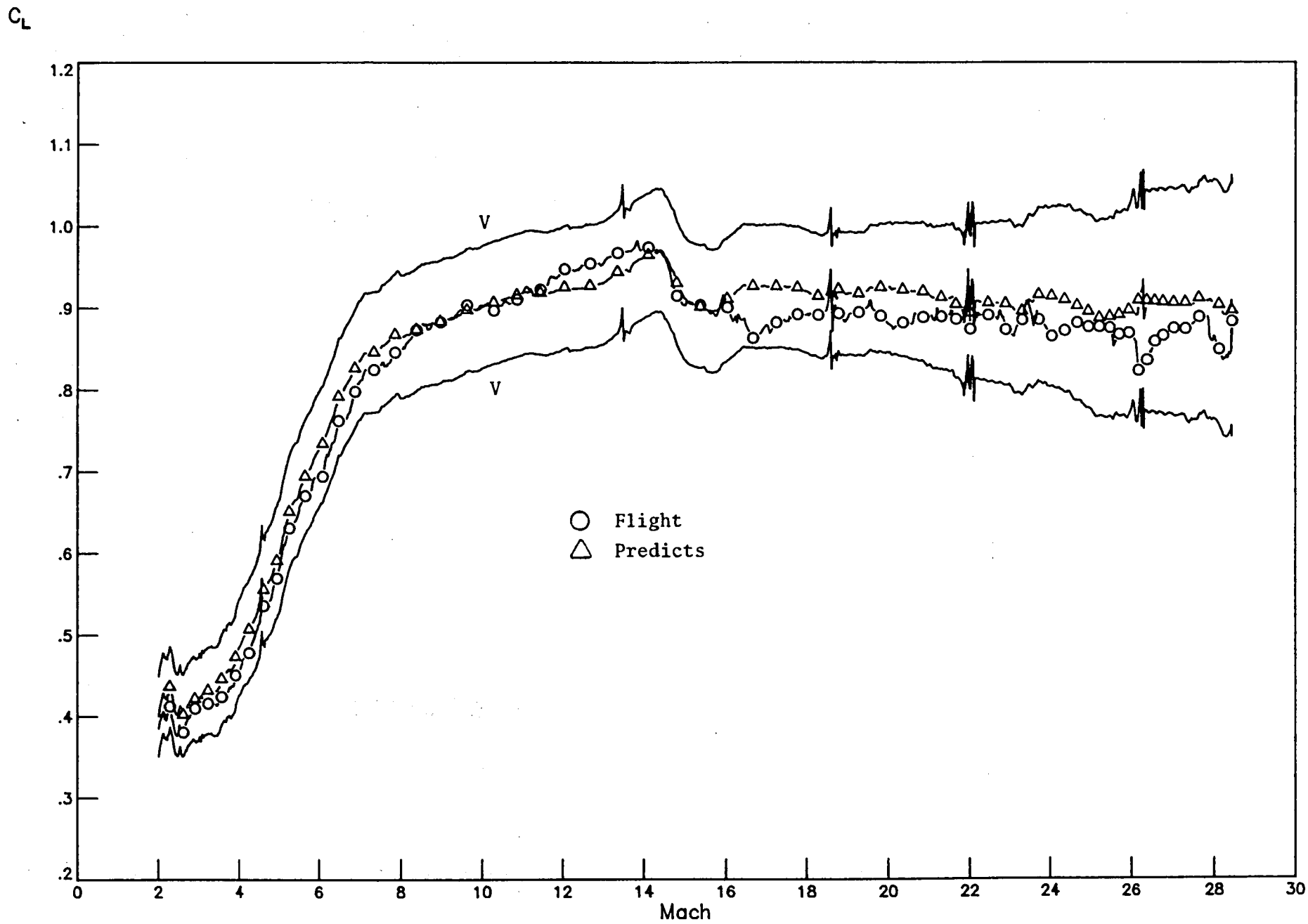


Figure III-19a. STS-13 lift comparisons vs. Mach

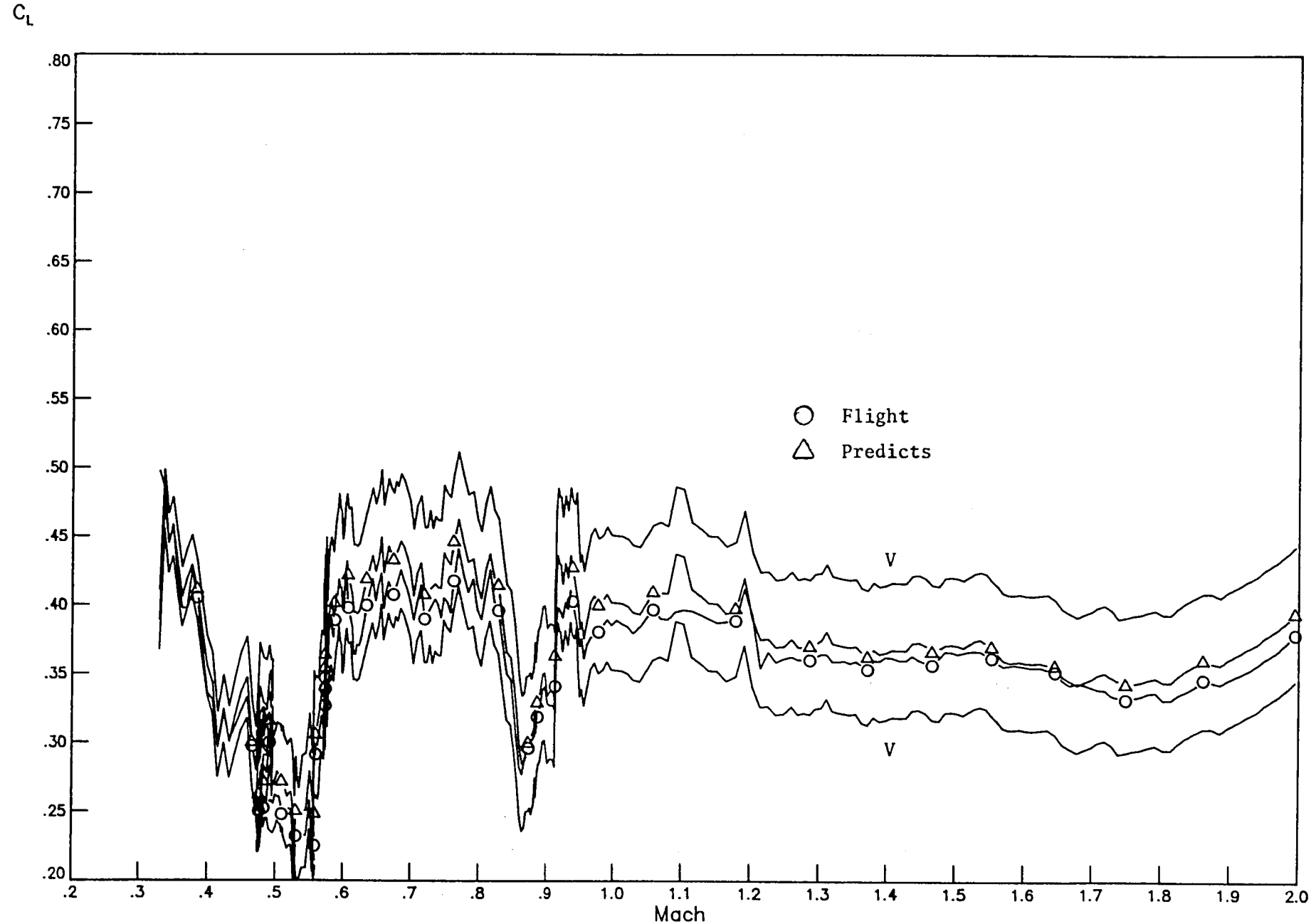


Figure III-19b. STS-13 lift comparisons vs. Mach

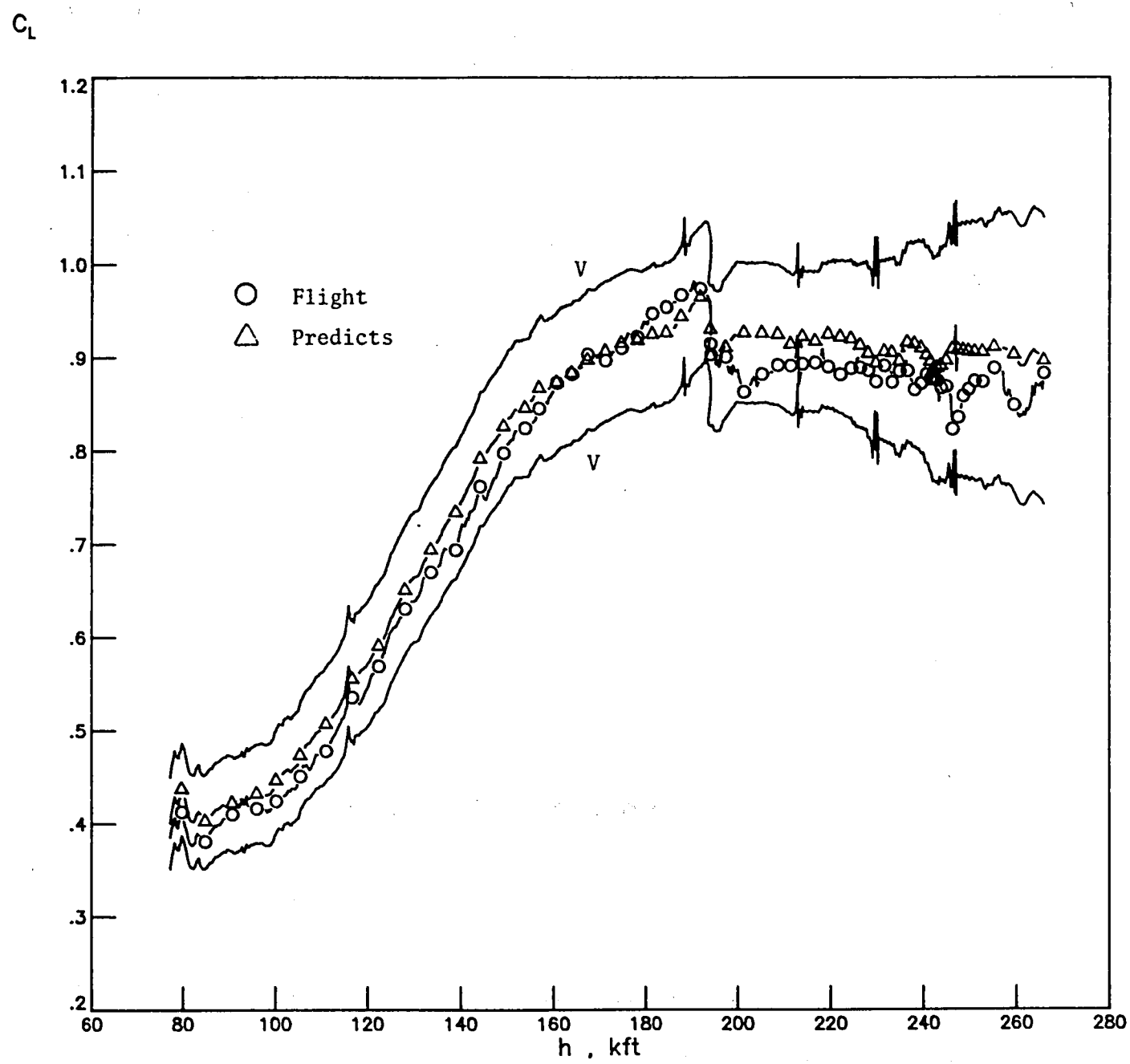


Figure III-20a. STS-13 lift comparisons vs. altitude

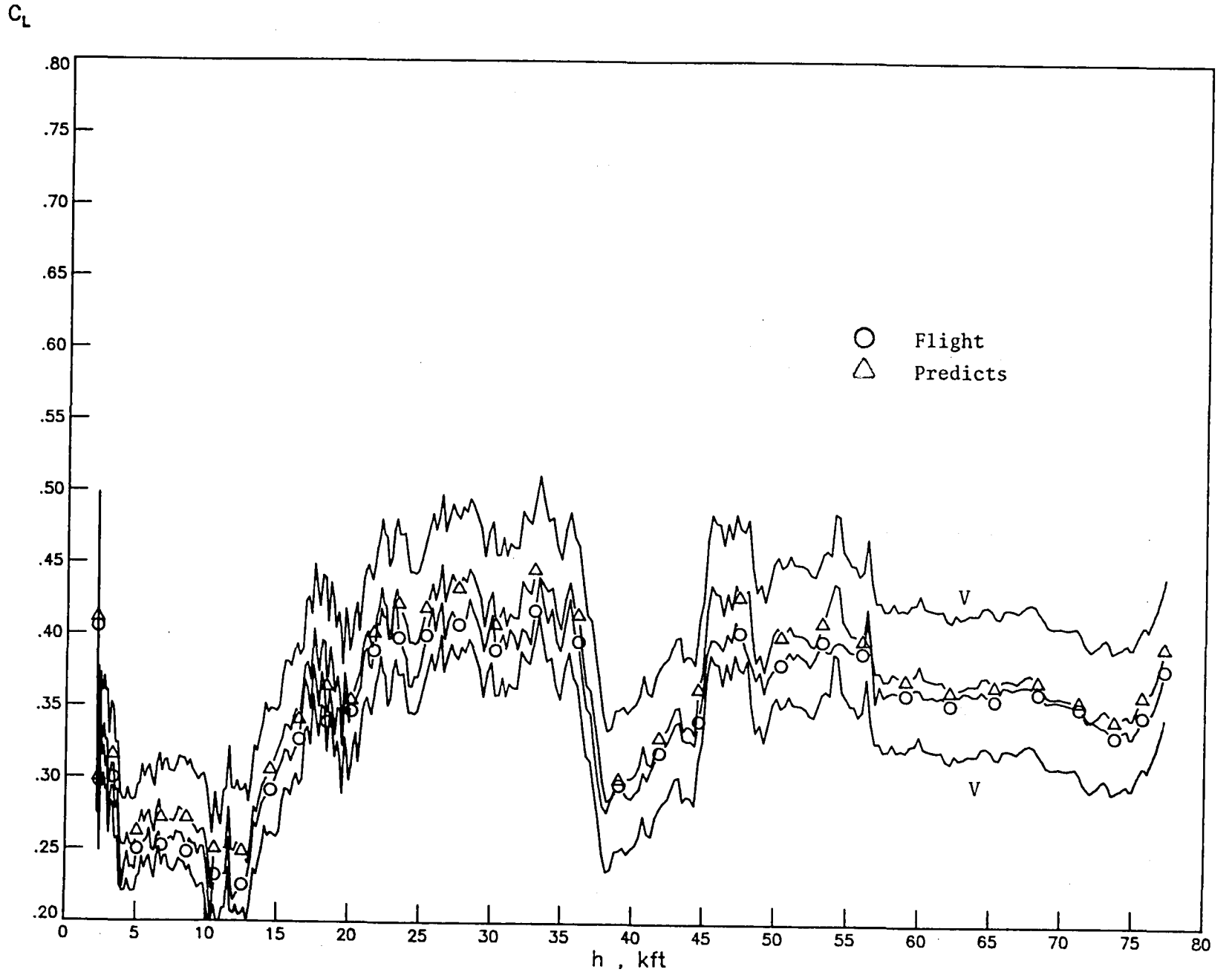


Figure III-20b. STS-13 lift comparisons vs. altitude

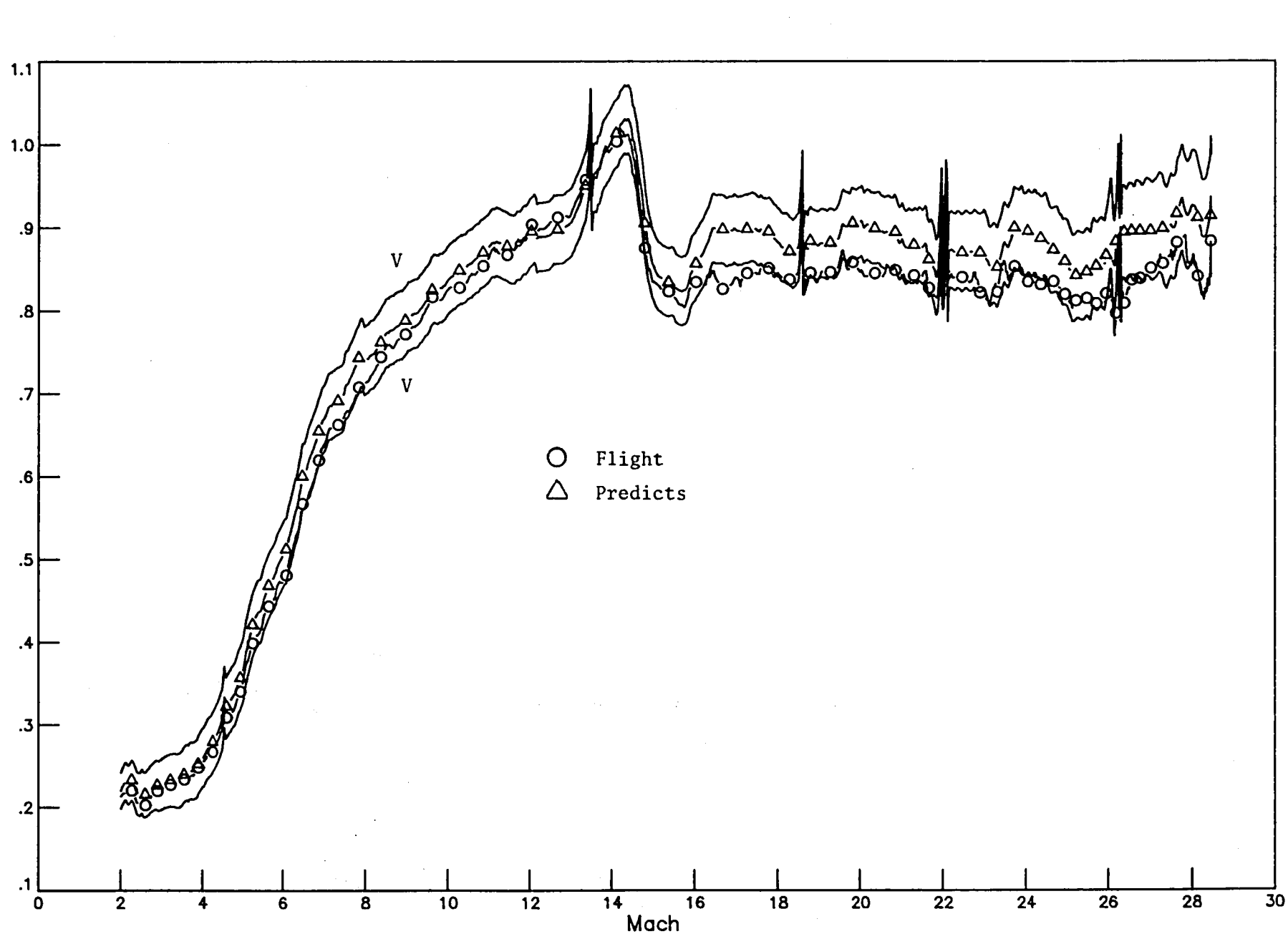


Figure III-21a. STS-13 drag comparisons vs. Mach

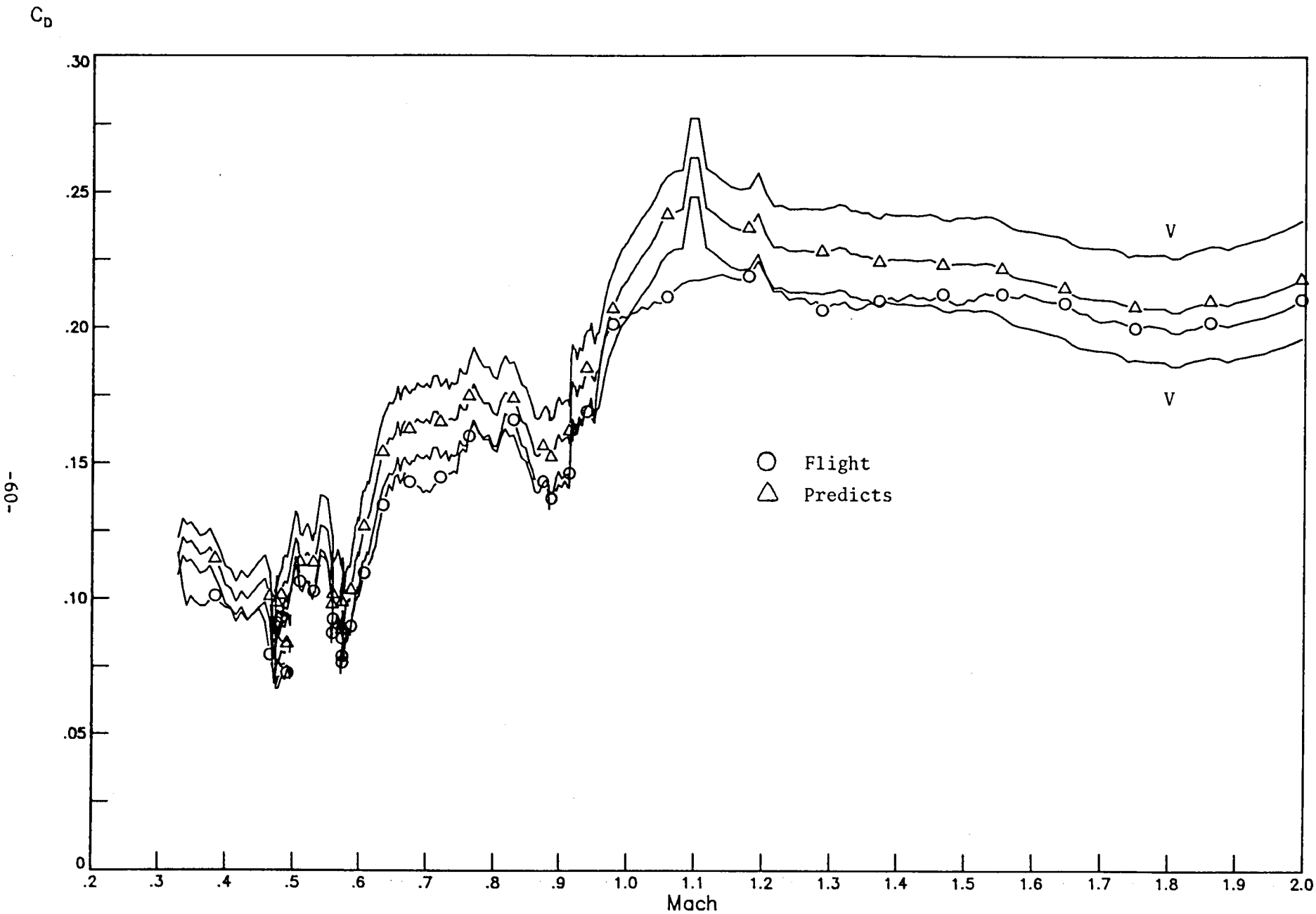


Figure III-21b. STS-13 drag comparisons vs. Mach

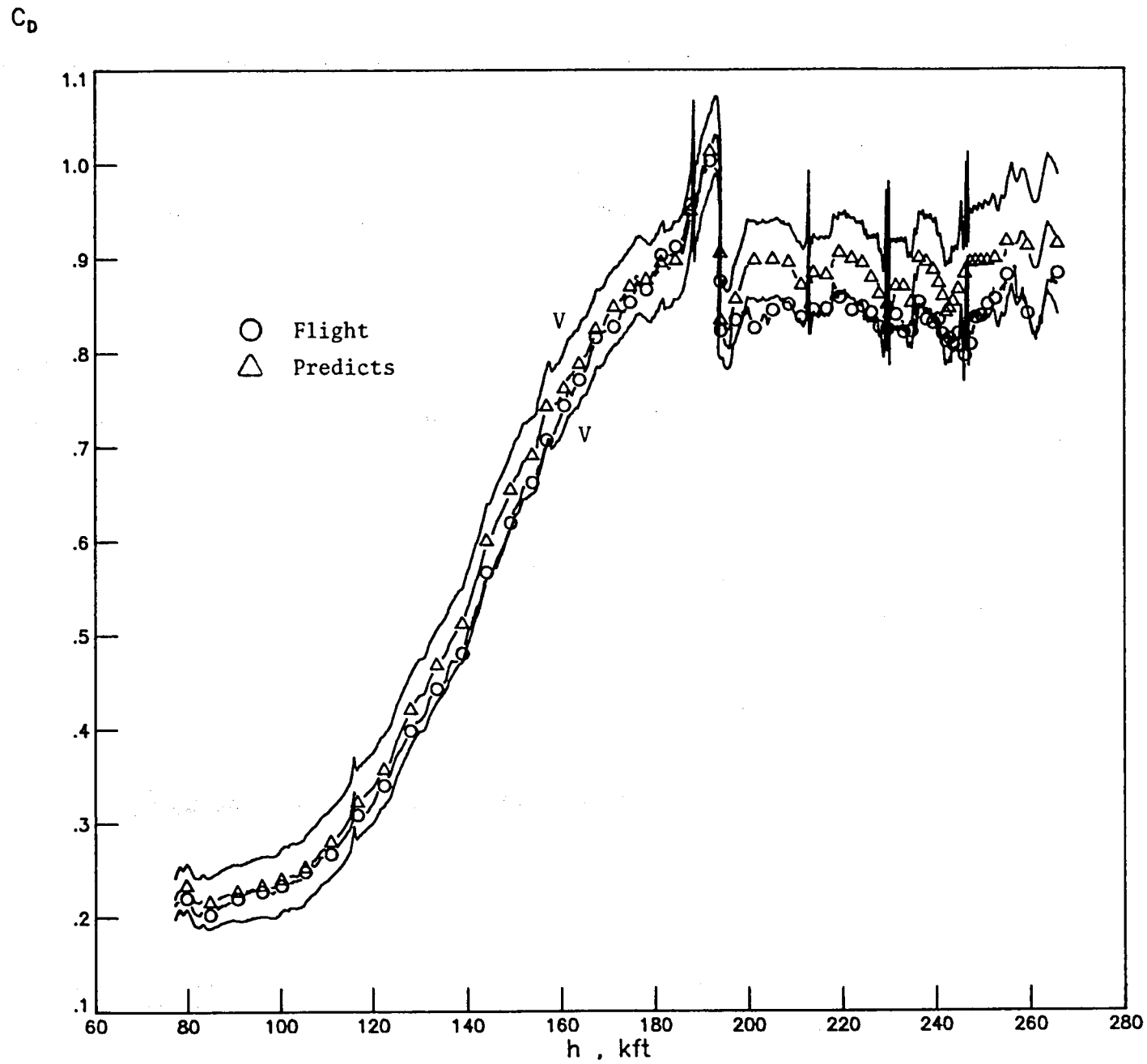


Figure III-22a. STS-13 drag comparisons vs. altitude

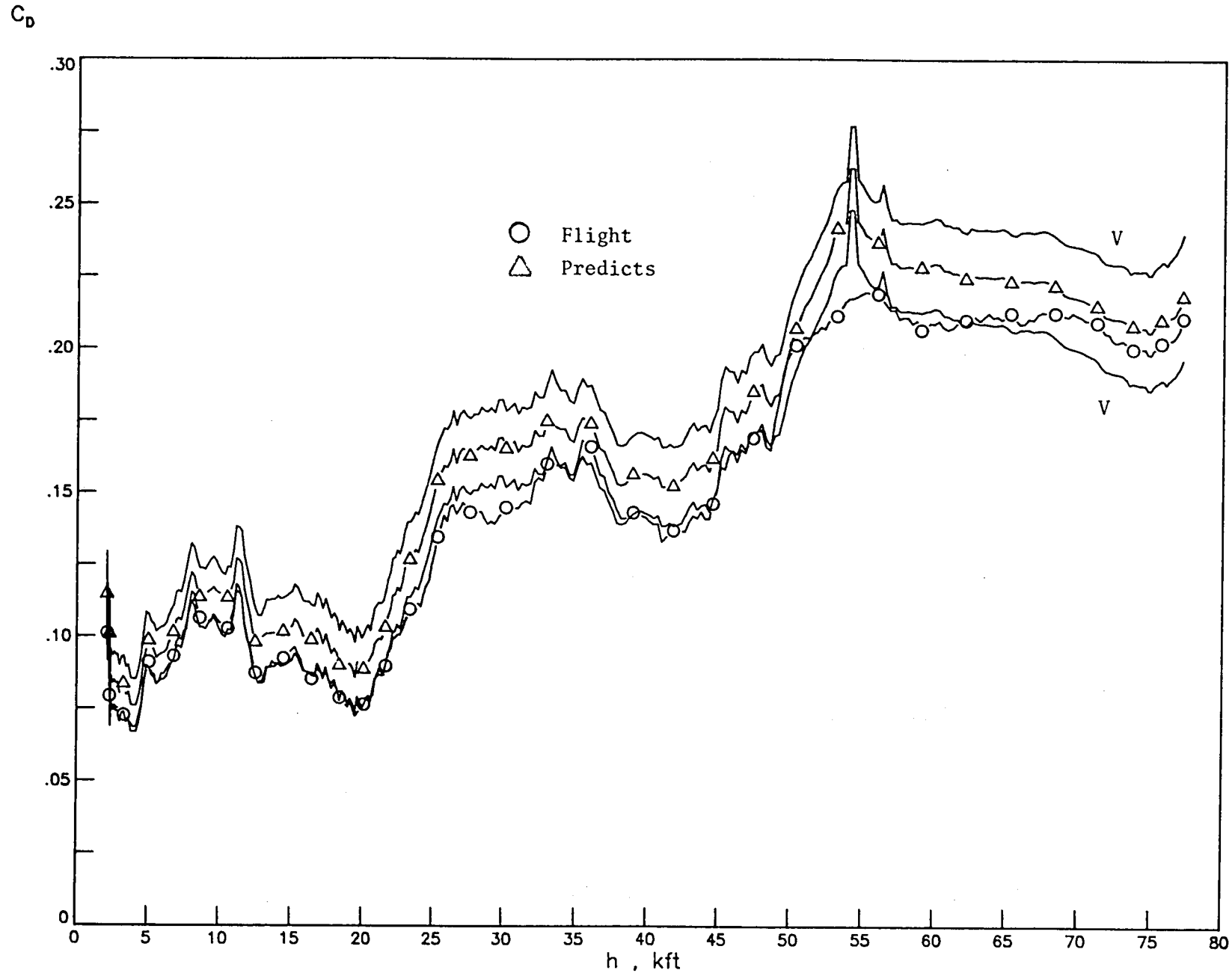


Figure III-22b. STS-13 drag comparisons vs. altitude

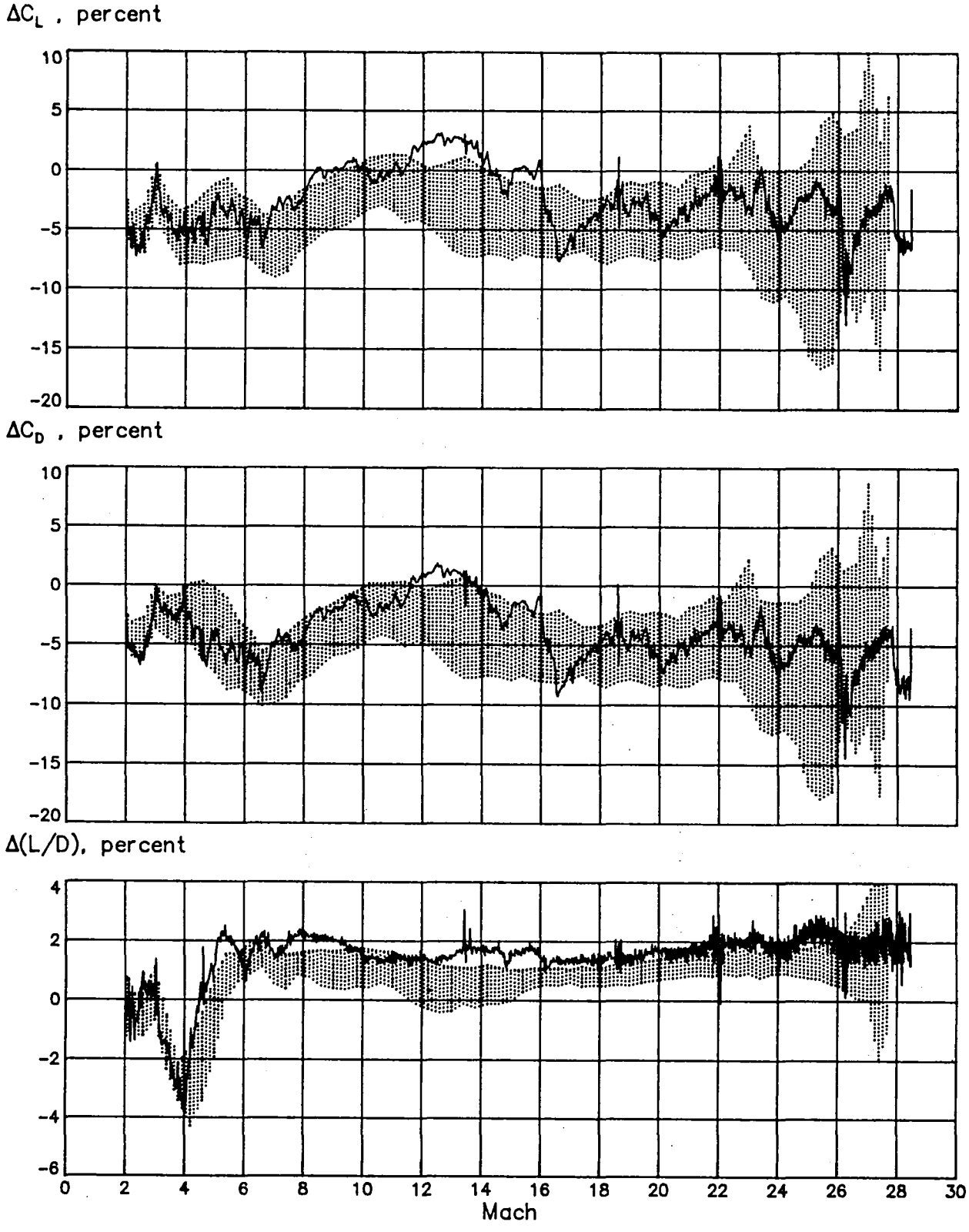


Figure III-23a.STS-13 flight/data base differences vs. Mach
(shaded region defined by previous ten flights)

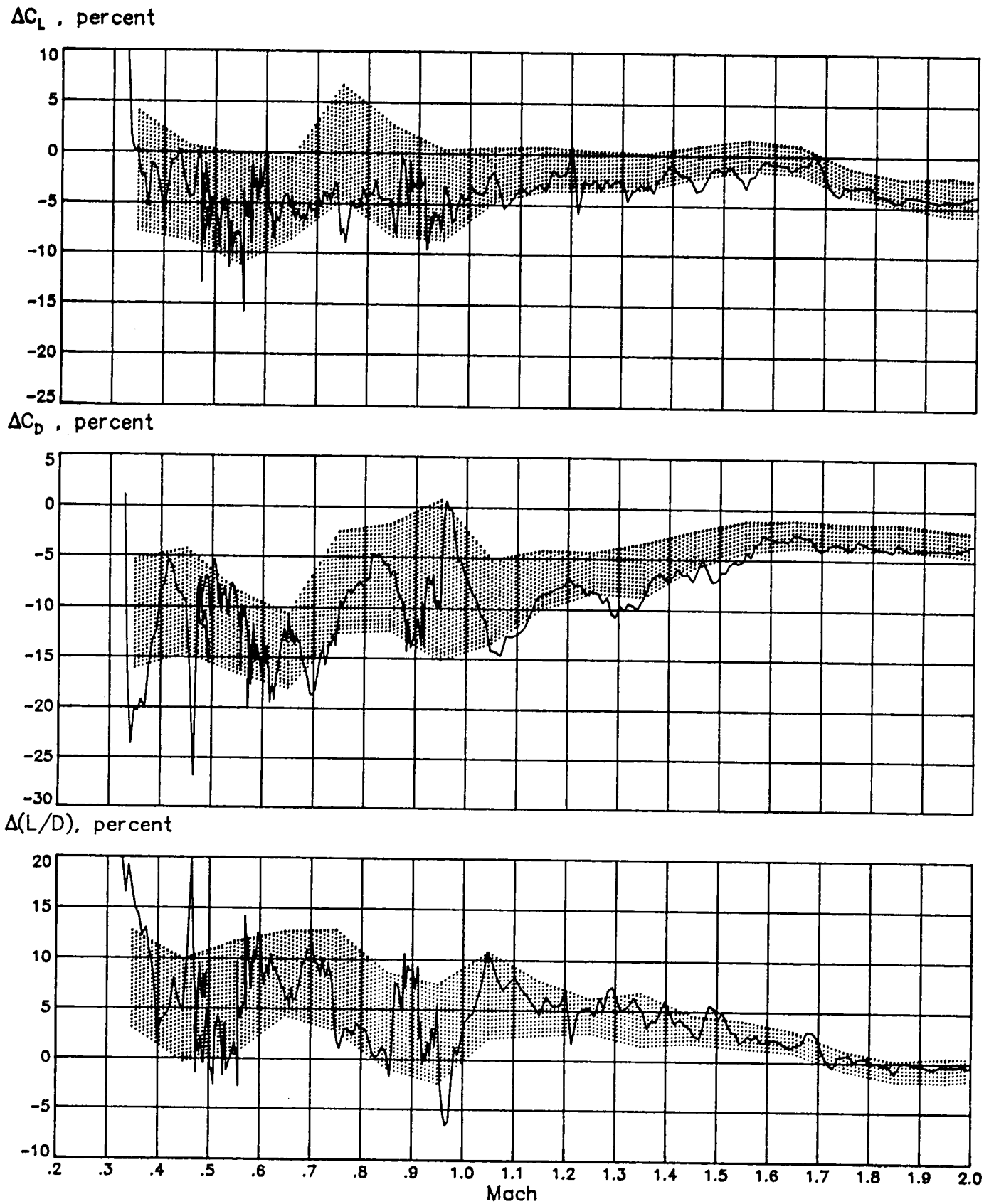


Figure III-23b.STS-13 flight/data base differences vs. Mach
(shaded region defined by previous ten flights)

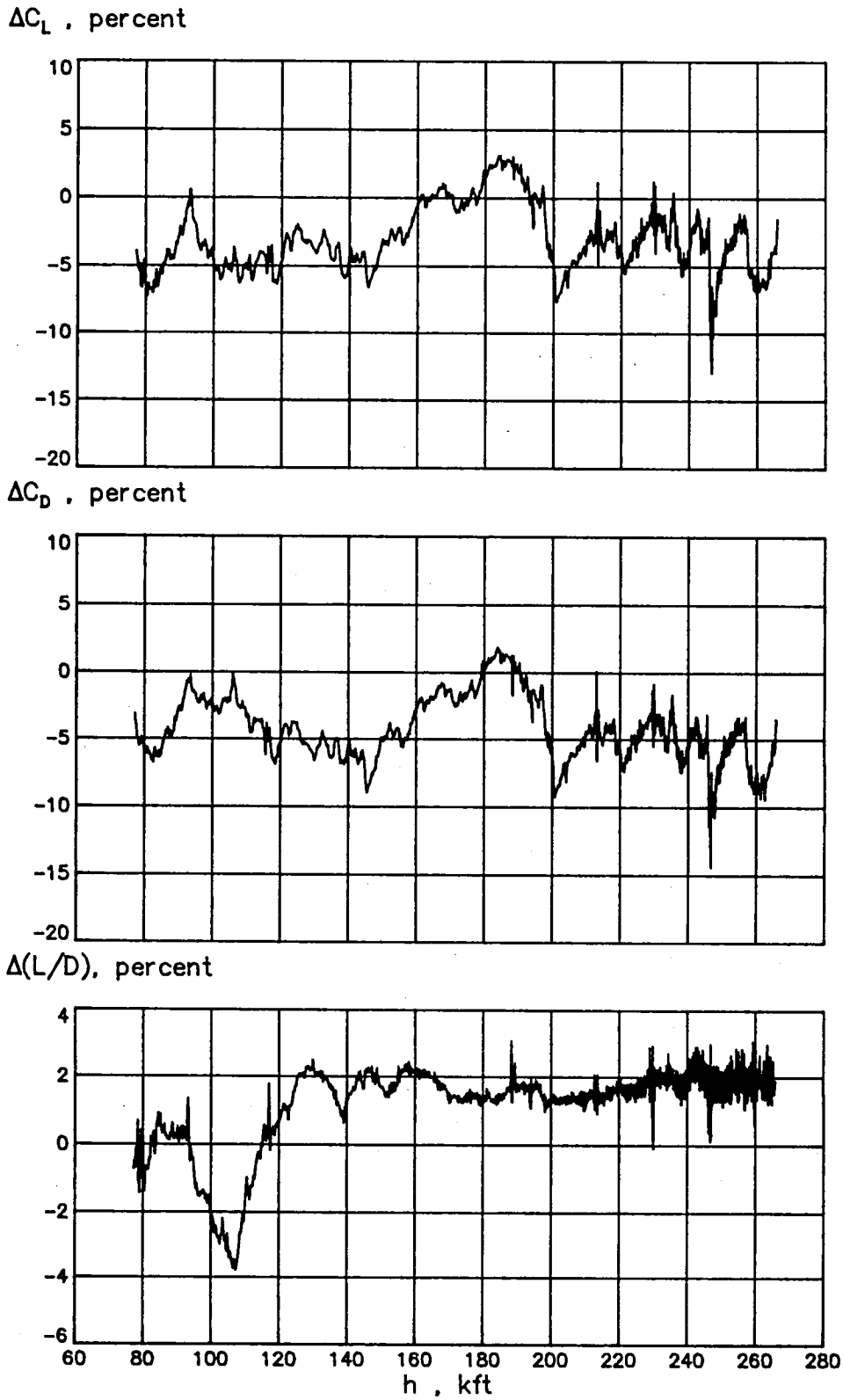


Figure III-24a. STS-13 flight/data base differences vs. h

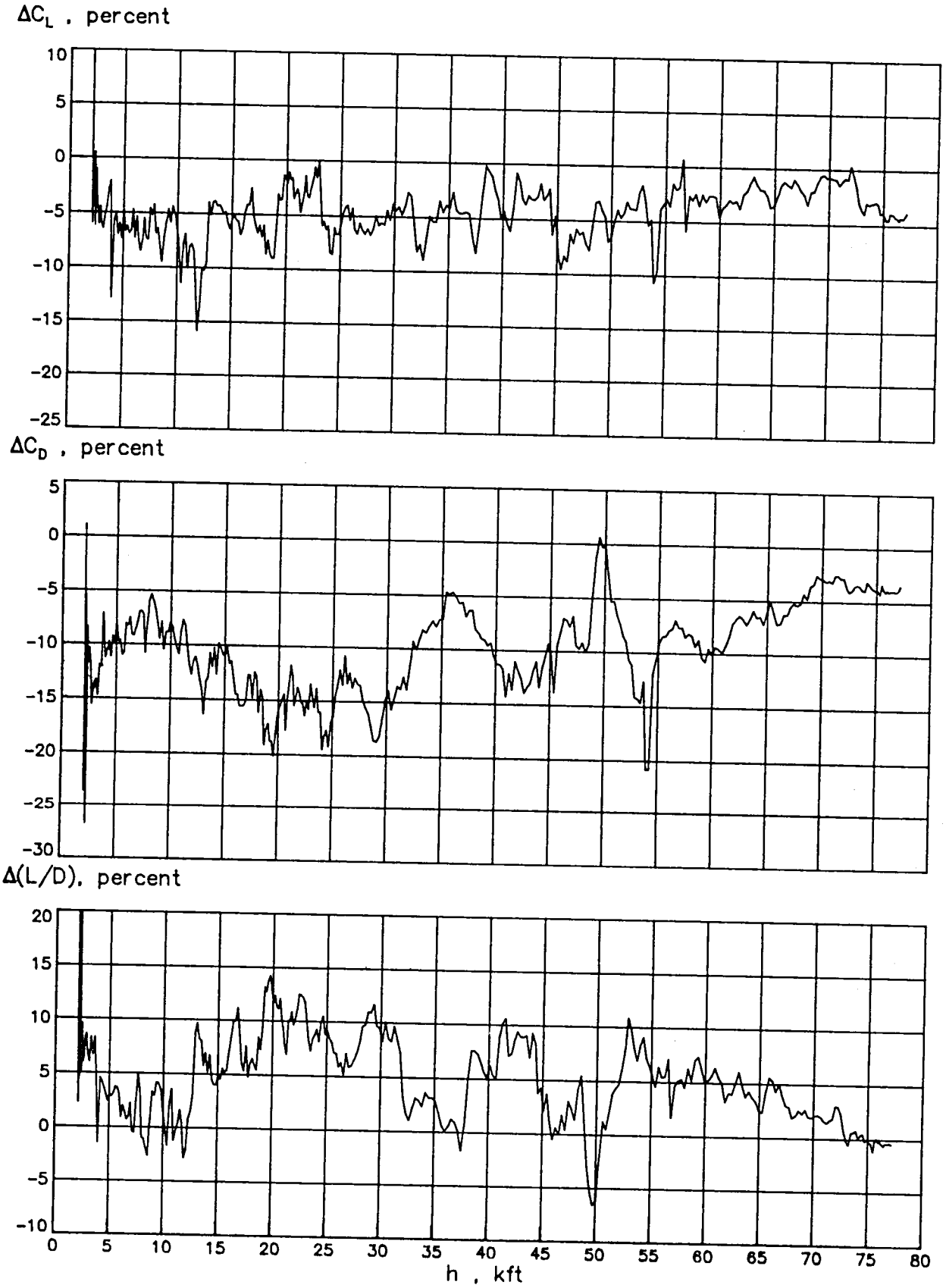


Figure III-24b. STS-13 flight/data base differences vs. h

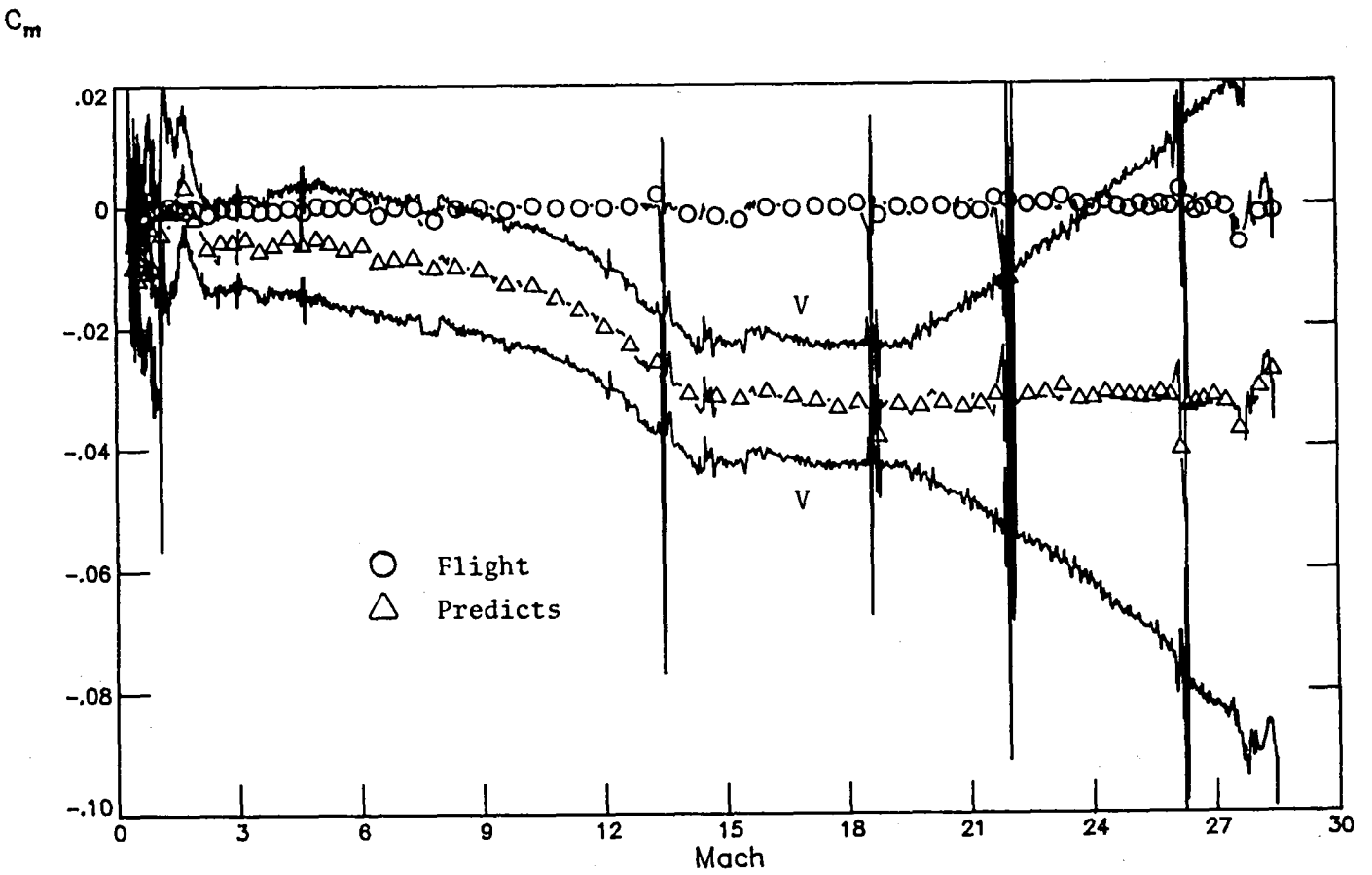


Figure III-25. STS-13 C_m comparisons vs. Mach
(at the flight c.g.)

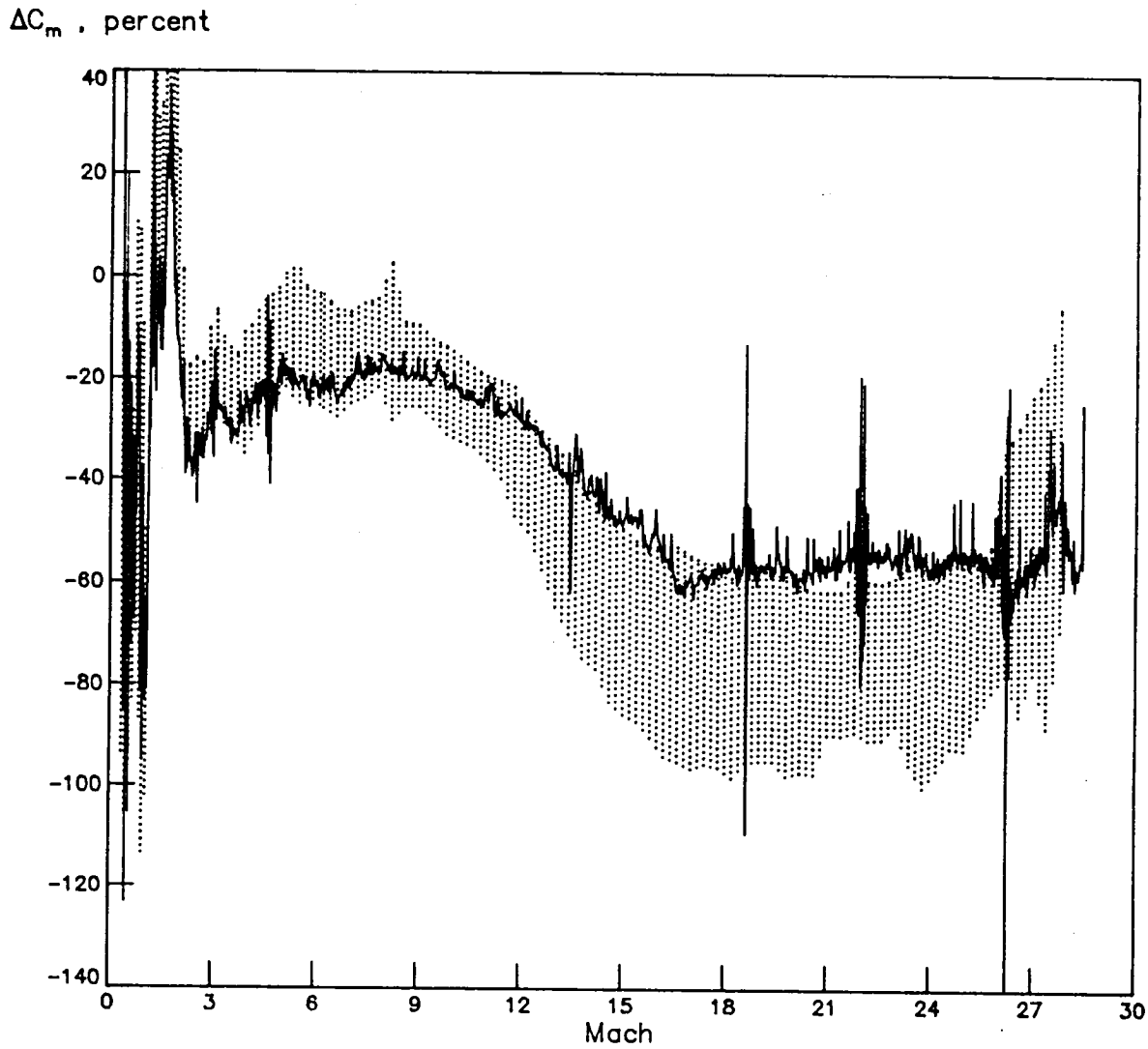


Figure III-26. ΔC_m comparisons vs. Mach (@ .65 X/ℓ)
(shaded region defined by previous ten flights)

IV. MMLE Input File Generation (GTFILEs)

MMLE input files were generated for STS-13 maneuver analyses. Maneuver activity during this flight is summarized as Table IV herein. GTFILEs were generated using the IMU2 data as well as the ACIP data though, for the latter as was the case for STS-11, RGA yaw rate data were incorporated due to the loss of ACIP measurements in that channel. Files created are on nine-track reels NC0760 (based on IMU2) and NC0757 (replacing IMU2 measurements with the merged, rectified, ACIP and RGA data). The extent of bias removal for rectification of these latter data is shown as Figures IV-1. Here, 100 second sub-interval biases (relative to the more accurate IMU data) were computed. These plots start at $t = 300$ seconds from epoch ($h \sim 458$ kft), i.e., well above appreciable signal in the accelerometry. Annotated on each sub-figure are the ensemble mean (μ_{avg}) over the entire time span as well as an estimate in the variation (1σ) of the mean difference over the arc. It is worthy of note that the input OI file, NT0831, had the previously discussed erroneous body flap deflection for $1943<t<1945$. For the GTFILE development, this spurious signal was not removed. It should be of no significance since no major maneuvers occur within this interval.

HR	MIN	SEC	SECS FROM EPOCH	MANEUVER TYPE	MANEUVER DURATION (SECS)
13	11	30	600	PTI-1, lat @ q~6	8
13	11	37.5	607.5	PTI-1, long @ q~7	9
13	12	17	677	lat, δ_A @ q~13	6
13	13	18	738	PTI-2, long @ q~20	12
13	13	29	749	PTI-2, lat @ q~20	8
13	18	45.5	1035.5	PTI-3, long	12
13	18	57	1047	PTI-3, lat	8
13	21	8	1178	PTI-4, lat	7
13	21	16.5	1186.5	PTI-4, long	7
13	23	3.5	1293.5	BRB	5
13	23	27	1317	BRE	9
13	23	50	1340	incidental; 2,3 jets	5
13	23	57	1347	PTI-5, lat	5
13	24	6	1356	PTI-5, long	4
13	26	5	1475	incidental; 2,4 jets	5
13	27	3.5	1533.5	BRB	5
13	27	22	1552	BRE	4
13	27	42	1572	incidental, lat	5
13	28	8	1598	incidental, lat	9
13	29	43.5	1693.5	PTI-7, lat	9
13	29	51	1701	PTI-7, long	4
13	30	37	1747	BRB	3
13	30	51.5	1761.5	BRE	3
13	31	15.5	1785.5	PTI-8, lat	16
13	31	18	1788	incidental, long	8
13	32	11	1841	PTI-9, lat @ M~2.1	14
13	32	34	1864	incidental, long δ_{BF}	16
13	33	30	1920	PTI-10, lat	14
13	33	44	1934	PTI-10, long	5
13	33	49	1939	incidental, lat	4
13	35	6	2016	incidental, long	14
13	35	43	2053	incidental, long	4
13	35	50	2060	incidental, long	6
13	35	58	2068	incidental, long	10
13	36	32	2102	incidental, long	5
13	36	49	2119	incidental, long	7

NOTES: BRB Bank Reversal Beginning

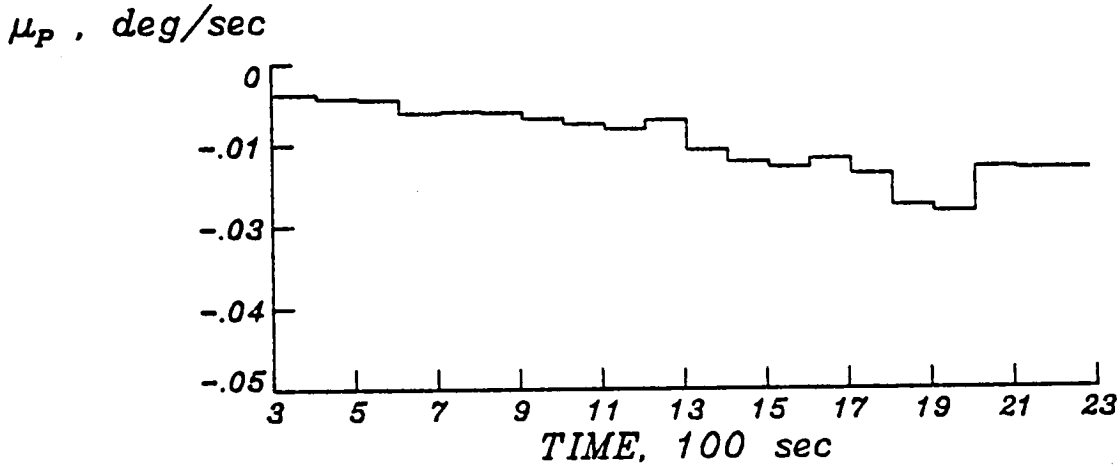
BRE Bank Reversal Ending

PTI Programmed Test Input

Table IV STS-13 (41-C) maneuver timeline

σ_μ = .00544

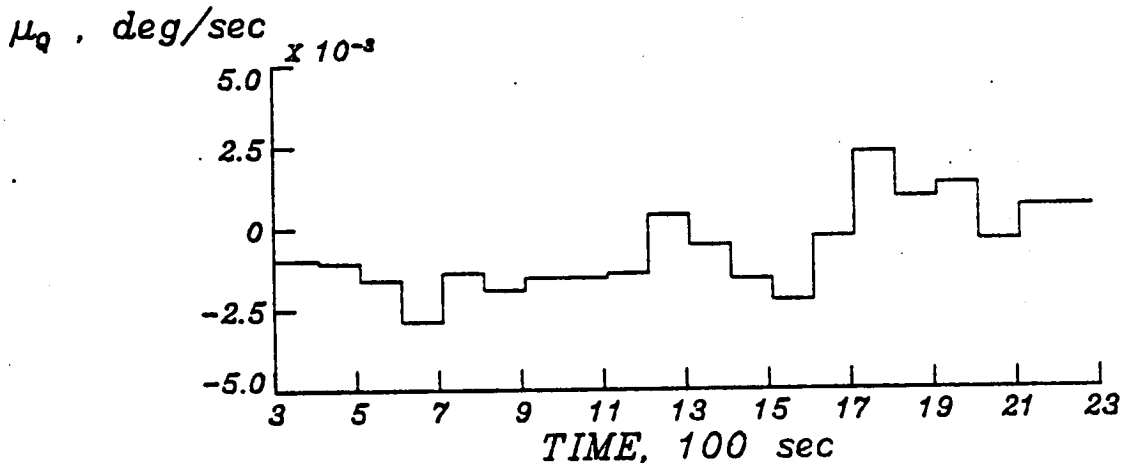
μ_{avg} = -.01211



(a) Roll rate statistics versus time

σ_μ = .00131

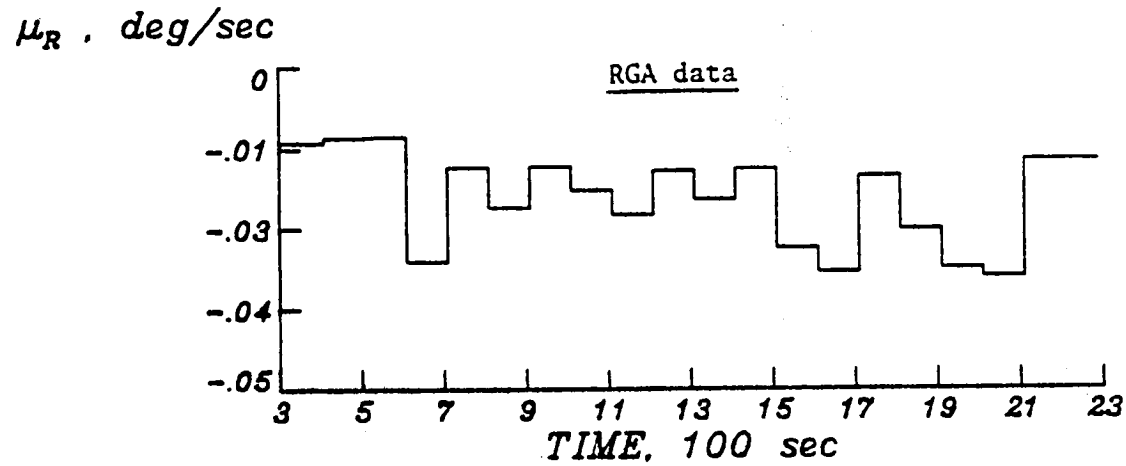
μ_{avg} = -.00073



(b) Pitch rate statistics versus time

σ_μ = .00724

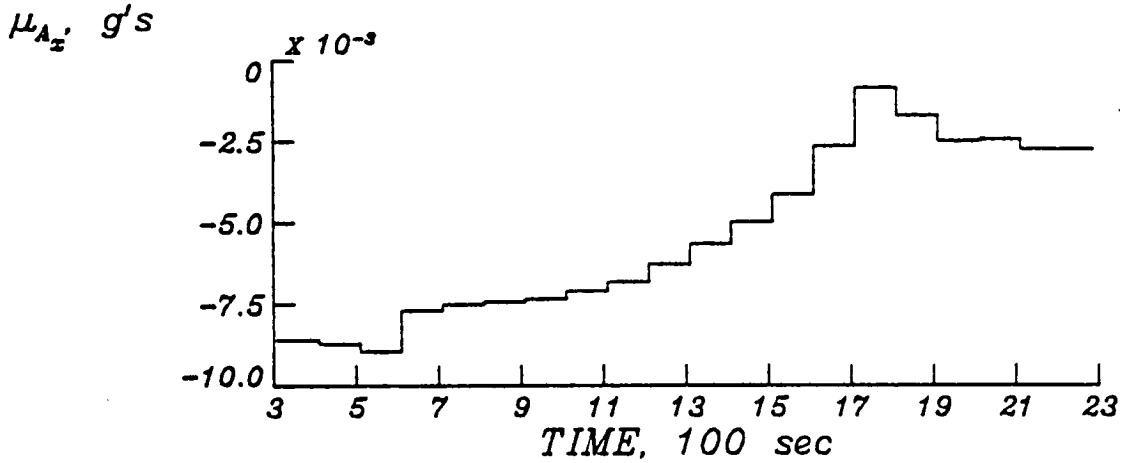
μ_{avg} = -.02056



(c) Yaw rate statistics versus time

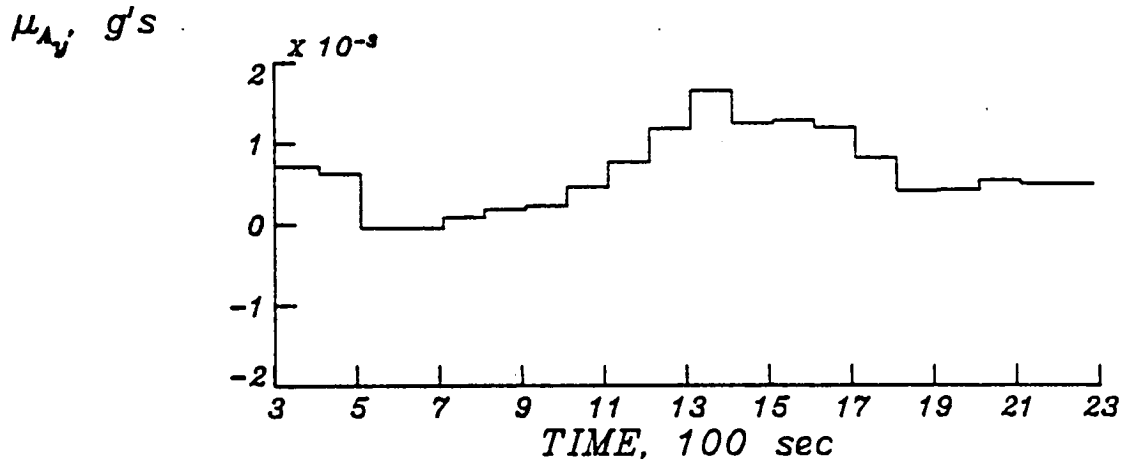
Figure IV-1. Dynamic data comparisons for STS-13.

σ_μ = .00259
μ_{avg} =-.00549



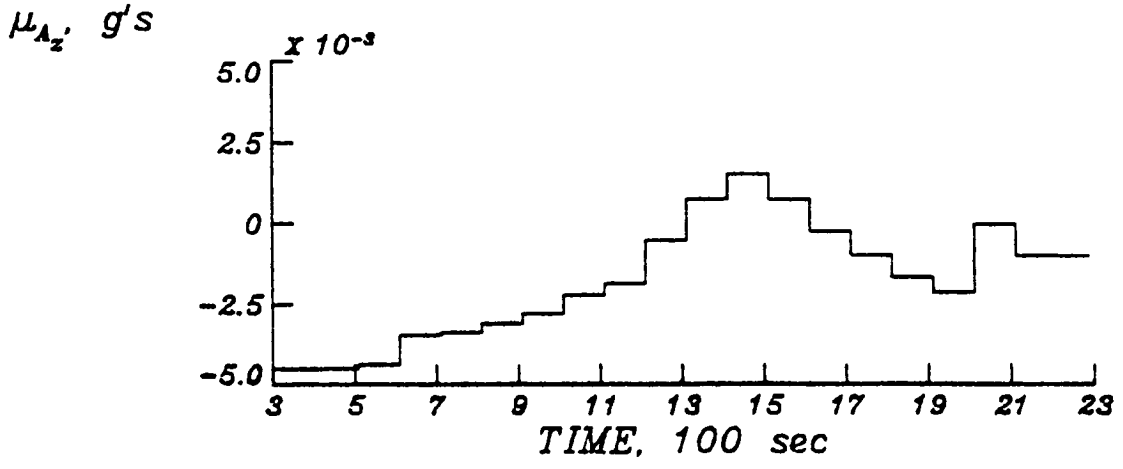
(d) X-body acceleration statistics versus time

σ_μ = .00048
μ_{avg} =.00064



(e) Y-body acceleration statistics versus time

σ_μ = .00183
μ_{avg} =-.00178

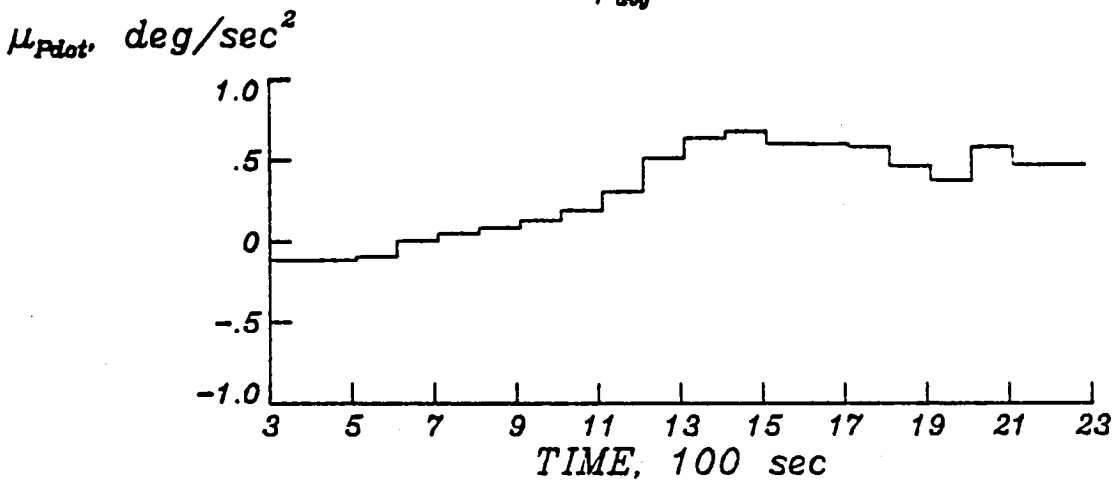


(f) Z-body acceleration statistics versus time

Figure IV-1. (continued)

σ_μ = .27942

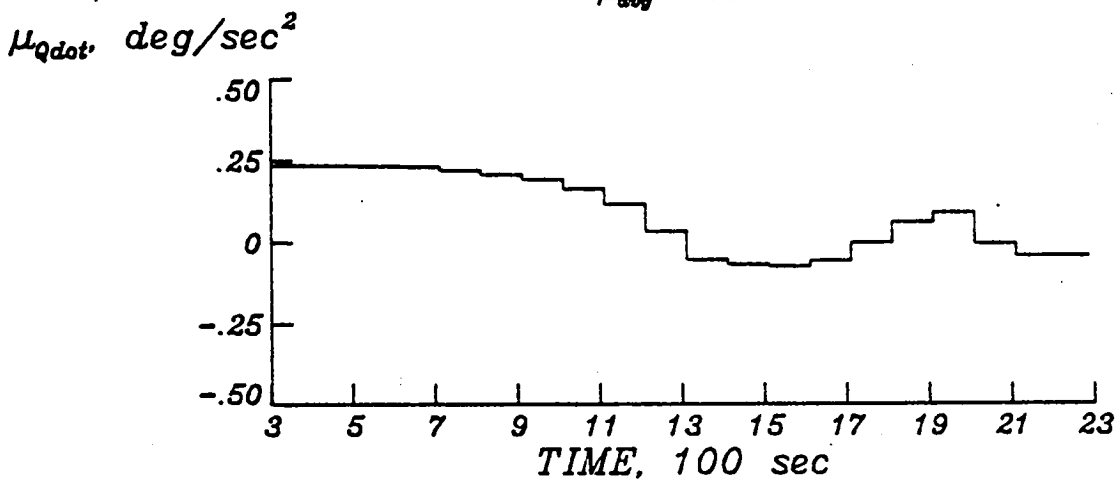
μ_{avg} =.31112



(g) P rate statistics versus time

σ_μ = .11902

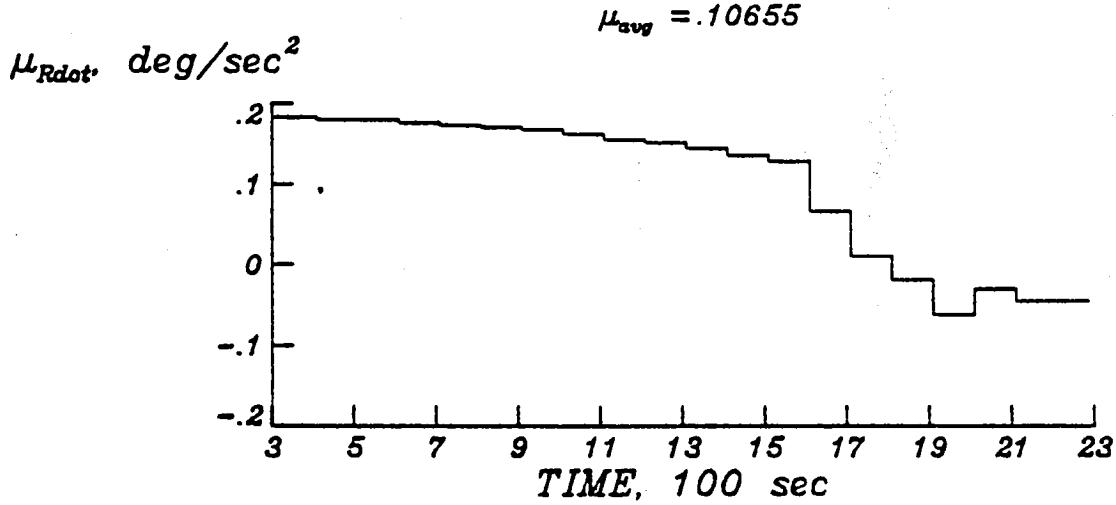
μ_{avg} =.09063



(h) Q rate statistics versus time

σ_μ = .08706

μ_{avg} =.10655



(i) R rate statistics versus time

Figure IV-1. (concluded).

APPENDIX A

Spacecraft and Physical Constants

+++++IMU NBR 1 ATTITUDE INFORMATION+++++

...INERTIAL (EE50) TO ROTATING (ETOD)

.80034129E+00	.59953885E+00	-.26439016E-02
-.59953560E+00	.80034566E+00	.19730078E-02
.32989300E-02	.60334727E-03	.99999456E+00

...ROTATING (ETOD) TO N-E-D

-.19262865E-01	.11101527E-01	.99975282E+00
-.49932837E+00	-.86641282E+00	0.
.86619860E+00	-.49920495E+00	.22232918E-01

...NAV BASE TO S/C BODY

.98291057E+00	.36562364E-03	-.18408337E+00
-.37935496E-03	.99999993E+00	-.39375571E-04
.18408334E+00	.10853560E-03	.98291063E+00

...NAV BASE TO OUTER ROLL

.99999950E+00	-.91449388E-03	.40092134E-03
.91449361E-03	.99999958E+00	.36664027E-06
-.40092151E-03	0.	.99999992E+00

...PLATFORM TO OUTER ROLL

.21530966E+00	.22629040E+00	-.94996519E+00
-.76488834E+00	-.56569402E+00	-.30811527E+00
-.60711369E+00	.79295766E+00	.51287989E-01

...INERTIAL (EE50) TO PLATFORM

-.65911311E+00	.37335742E+00	.65282011E+00
.66352141E+00	-.11989605E+00	.73848784E+00
.35399044E+00	.91990715E+00	-.16870552E+00

...S/C BODY TO N-E-D

.43675114E+00	-.86461652E+00	.24836610E+00
.69140526E+00	.49926121E+00	.52220295E+00
-.57550566E+00	-.56350921E-01	.81585386E+00

TABLE A-1

STS-13 IMU attitude matrices @ Epoch

+++++IMU NBR 2 ATTITUDE INFORMATION+++++

...INERTIAL (EE50) TO ROTATING (ETOD)

.80034129E+00	.59953885E+00	-.26439016E-02
-.59953560E+00	.80034566E+00	.19730078E-02
.32989300E-02	.60334727E-05	.99999456E+00

...ROTATING (ETOD) TO N-E-D

-.19262885E-01	.11101527E-01	.99975282E+00
-.49932837E+00	-.86641282E+00	0.
.86619866E+00	-.49920495E+00	.22232918E-01

...NAV BASE TO S/C BODY

.98291057E+00	.36562364E-03	-.18408337E+00
-.37935496E-03	.99999993E+00	-.39375571E-04
.18408334E+00	.10853560E-03	.98291063E+00

...NAV BASE TO OUTER ROLL

.99999530E+00	-.74577054E-03	-.62278928E-03
.74578641E-03	.99999972E+00	.25249802E-04
.62277028E-03	-.25714258E-04	.99999981E+00

...PLATFORM TO OUTER ROLL

-.35870630E+00	.80057320E+00	.48001198E+00
-.80414729E+00	-.52615386E+00	.27660137E+00
.47400010E+00	-.28678168E+00	.83251431E+00

...INERTIAL (EE50) TO PLATFORM

.54944223E+00	.56670505E+00	.61396956E+00
-.54542106E+00	-.31339467E+00	.77736712E+00
.63295263E+00	-.76199025E+00	.13690060E+00

...S/C BODY TO N-E-D

.43679833E+00	-.86430667E+00	.24935612E+00
.89074052E+00	.49983717E+00	.52252719E+00
-.57626005E+00	-.55998876E-01	.81534440E+00

TABLE A-1

(continued)

+++++IMU NBR 3 ATTITUDE INFORMATION+++++

...INERTIAL (EE50) TO ROTATING (ETOD)

.80034129E+00	.59953885E+00	-.26439016E-02
-.59953560E+00	.80034566E+00	.19730078E-02
.32989300E-02	.60334727E-05	.99999456E+00

...ROTATING (ETOD) TO N-E-D

-.19262885E-01	.11101527E-01	.99975282E+00
-.49932837E+00	-.86641282E+00	0.
.86619866E+00	-.49920495E+00	.22232918E-01

...NAV BASE TO S/C BODY

.98291057E+00	.36562364E-03	-.18408337E+00
-.37935496E-03	.99999993E+00	-.39375571E-04
.18408334E+00	.10853560E-03	.98291063E+00

...NAV BASE TO OUTER ROLL

.99999429E+00	.12891322E-02	.31251399E-02
-.12891429E-02	.99999917E+00	.14160325E-05
-.31251355E-02	-.54447762E-05	.99999512E+00

...PLATFORM TO OUTER ROLL

.80509955E+00	-.36619034E+00	.46660402E+00
-.42819178E+00	-.90318960E+00	.29998920E-01
.41044668E+00	-.22394814E+00	-.88395721E+00

...INERTIAL (EE50) TO PLATFORM

.11657518E+00	-.55989254E+00	.82032347E+00
-.11210304E+00	.81325889E+00	.57100165E+00
-.98683488E+00	-.15852535E+00	.32040150E-01

...S/C BODY TO N-E-D

.43631726E+00	-.86451709E+00	.24947400E+00
.89156019E+00	.49957361E+00	.52169961E+00
-.57564868E+00	-.55100229E-01	.81583813E+00

TABLE A-1

(Concluded)

Planet Parameters

Physical Model

Polar Radius:	20,855,591.48 ft
Equatorial Radius:	20,925,741.47 ft
Rotational Rate:	.7292115147E-4 rad/sec

Gravity Model

Central mass, μ:	.1407646853E17 ft^3/sec^2
J_2:	.10827E-2
C_{30}:	.256E-5
C_{40}:	.158E-5
C_{22}:	.157E-5
S_{22}:	-.897E-6

Runway 17 Location:

Altitude:	2090.ft (above ellipsoid)
Geodetic Latitude:	34.930885 deg
Longitude:	242.163116 deg
Azimuth:	190.072211 deg

Location of IMU relative to center-of-gravity in Body coordinates

(Assumed constant for entry reconstruction)

X_B	56 ft
Y_B	0.0 ft
Z_B	-4 ft

Spacecraft aerodynamic reference parameters

Reference Area	2690 ft^2
Span	78.057 ft
Chord	39.567 ft

Average Attitude Computations @ Epoch (46890 sec)

	IMU1	IMU2	IMU3	μ	σ
ψ(deg)	57.7200	57.6923	57.7515	57.7212	0.0296
θ(deg)	35.1351	35.1880	35.1451	35.1560	0.0281
ϕ(deg)	-3.9511	-3.9290	-3.8638	-3.9146	0.0454

TABLE A-2.

Planet and Spacecraft Data Used for

BT13M23 , ST13BET, and AEROBET Generation

Weight and Center-of-Gravity (c.g.) Location

EVENT	TIME (sec from epoch)	WEIGHT (lbs)	X_{CG} (inches in Orbiter Structural Reference)	Y_{CG}	Z_{CG}
EI	382	198152.8	1101.5	-0.1	371.6
M3	1795	197232.8	1099.7	-0.1	371.0
Landing	2196	197057.8	1101.3	-0.1	368.2

Moments and Products of Inertia

EVENT	I_{XX}	I_{YY}	I_{ZZ}	I_{XY}	I_{XZ}	I_{YZ}
EI	898841.0	6661184.6	6959391.3	-4672.6	150451.1	-1587.8
M3	893656.5	6626678.4	6926881.1	-4510.0	140370.1	-1585.2
Landing	922665.4	6644962.1	6920668.1	-4319.4	134901.7	-1592.0

NOTES

EI values assumed at epoch

Mach 3 values held constant until gear deploy (t=2178), landed values adopted thereafter

TABLE A-3.

STS-13 mass properties.

APPENDIX B

Final residuals for STS-13 trajectory reconstruction

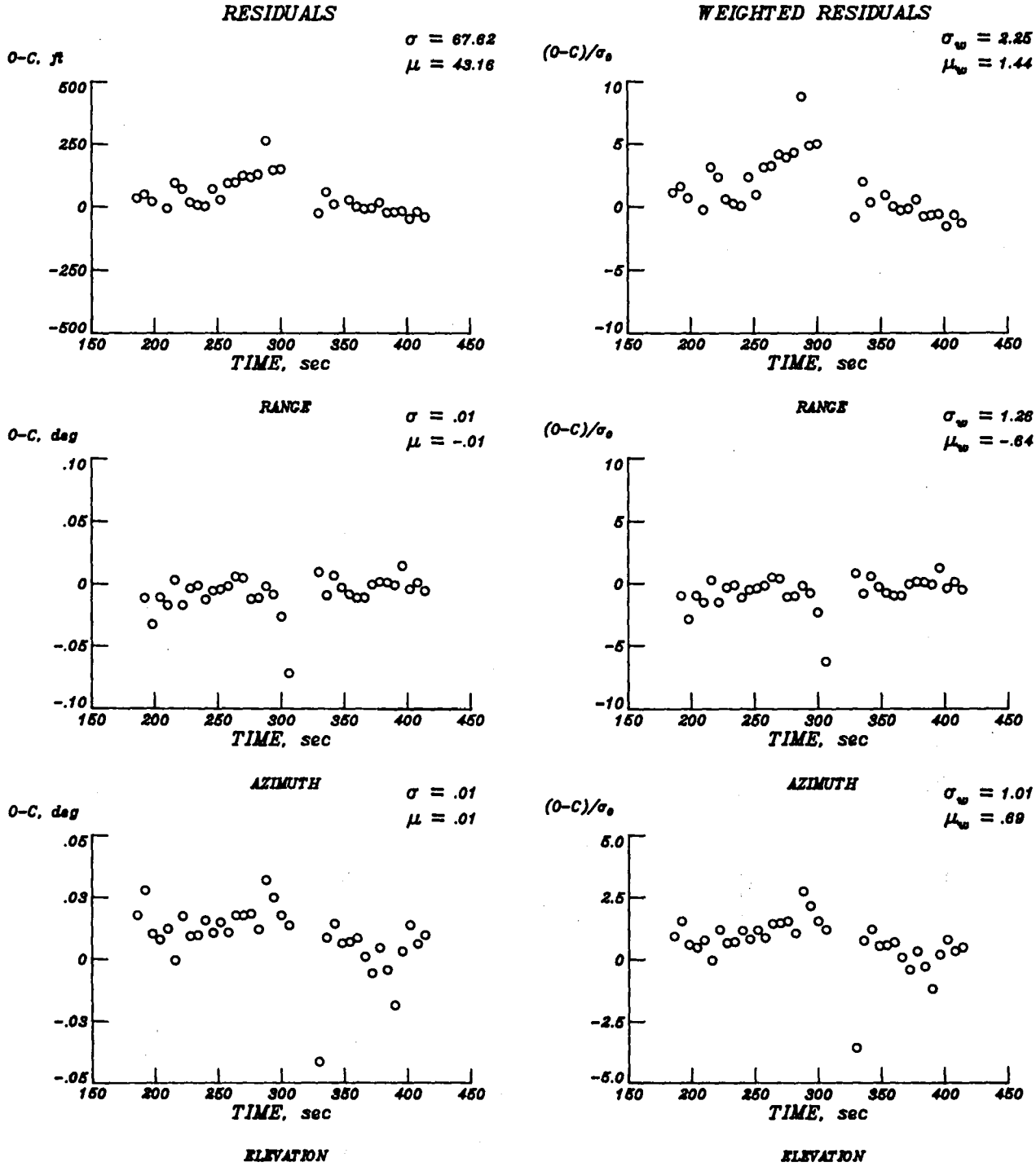


Fig. B-1. *Smoothed residuals versus time for KMTC*

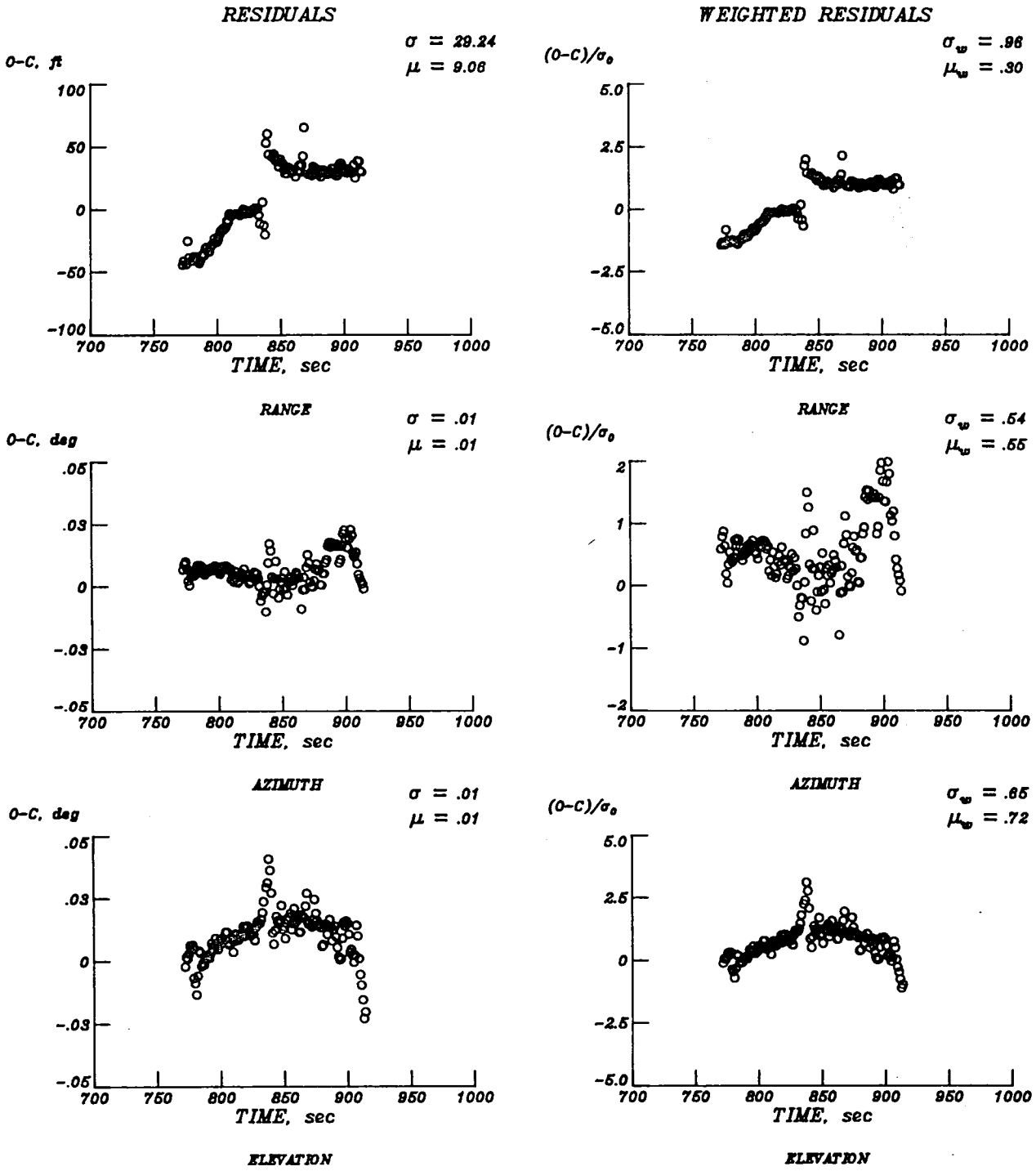


Fig. B-2. *Smoothed residuals versus time for KPTC*

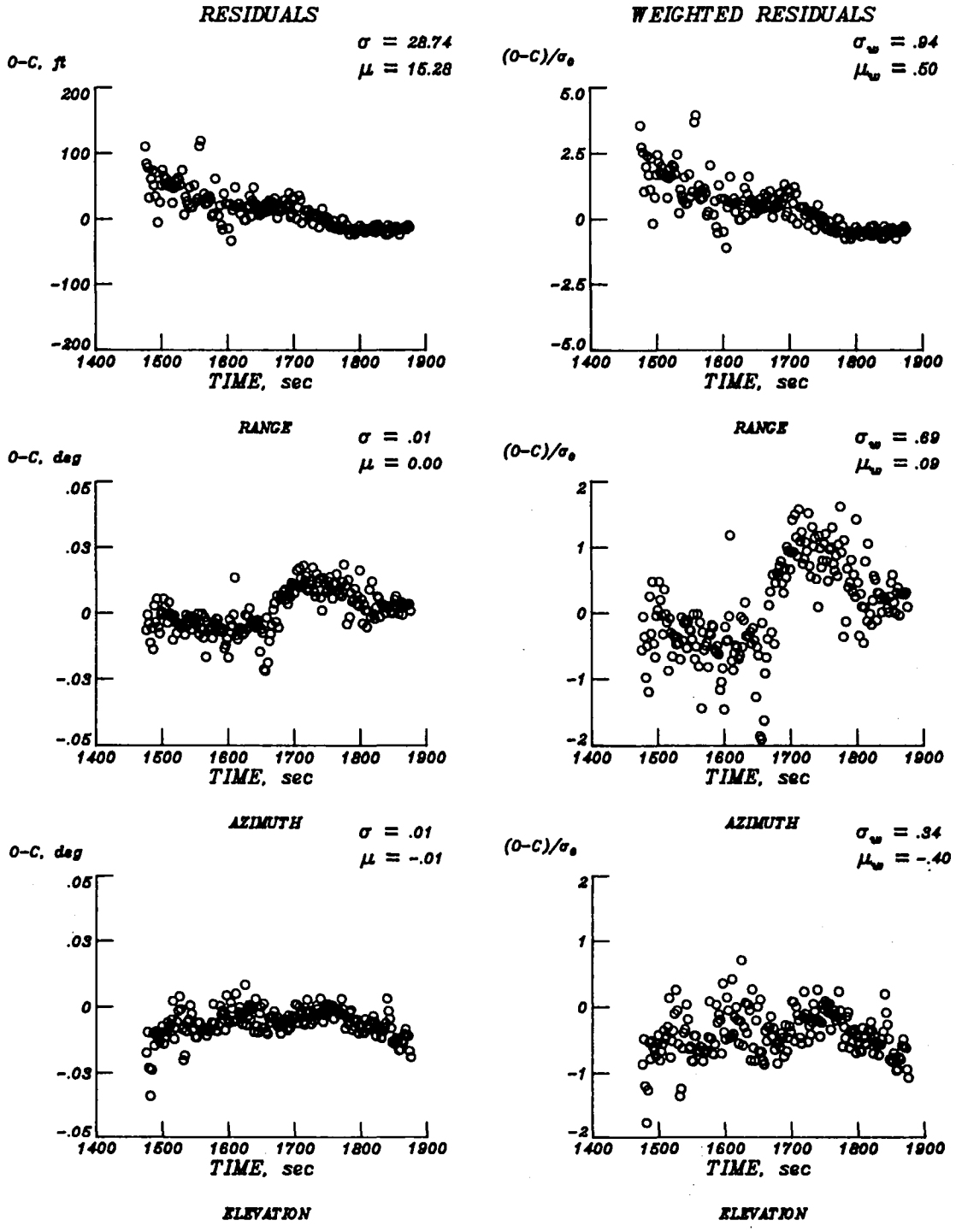


Fig. B-3. *Smoothed residuals versus time for VDBC*

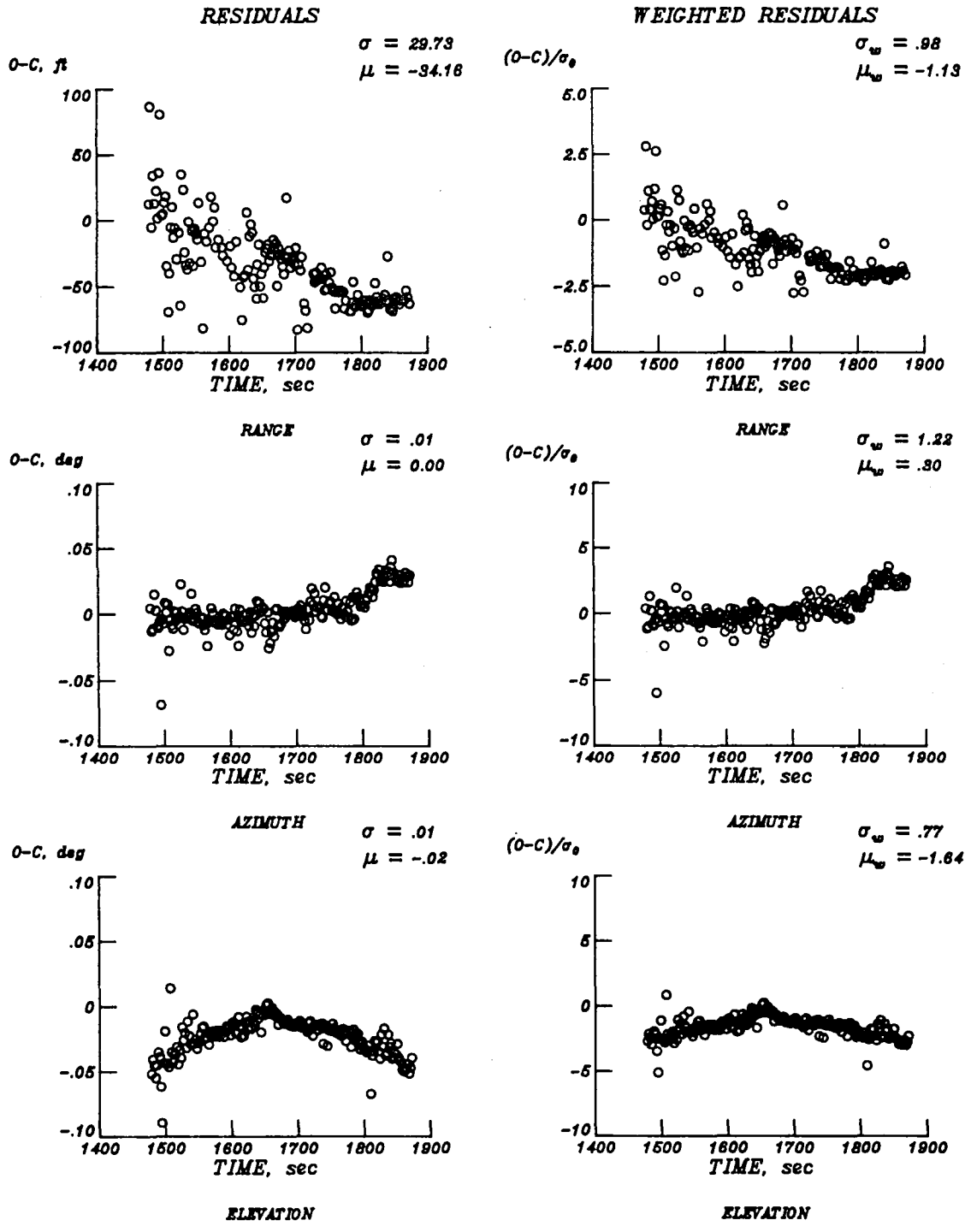


Fig. B-4. *Smoothed residuals versus time for VDSC*

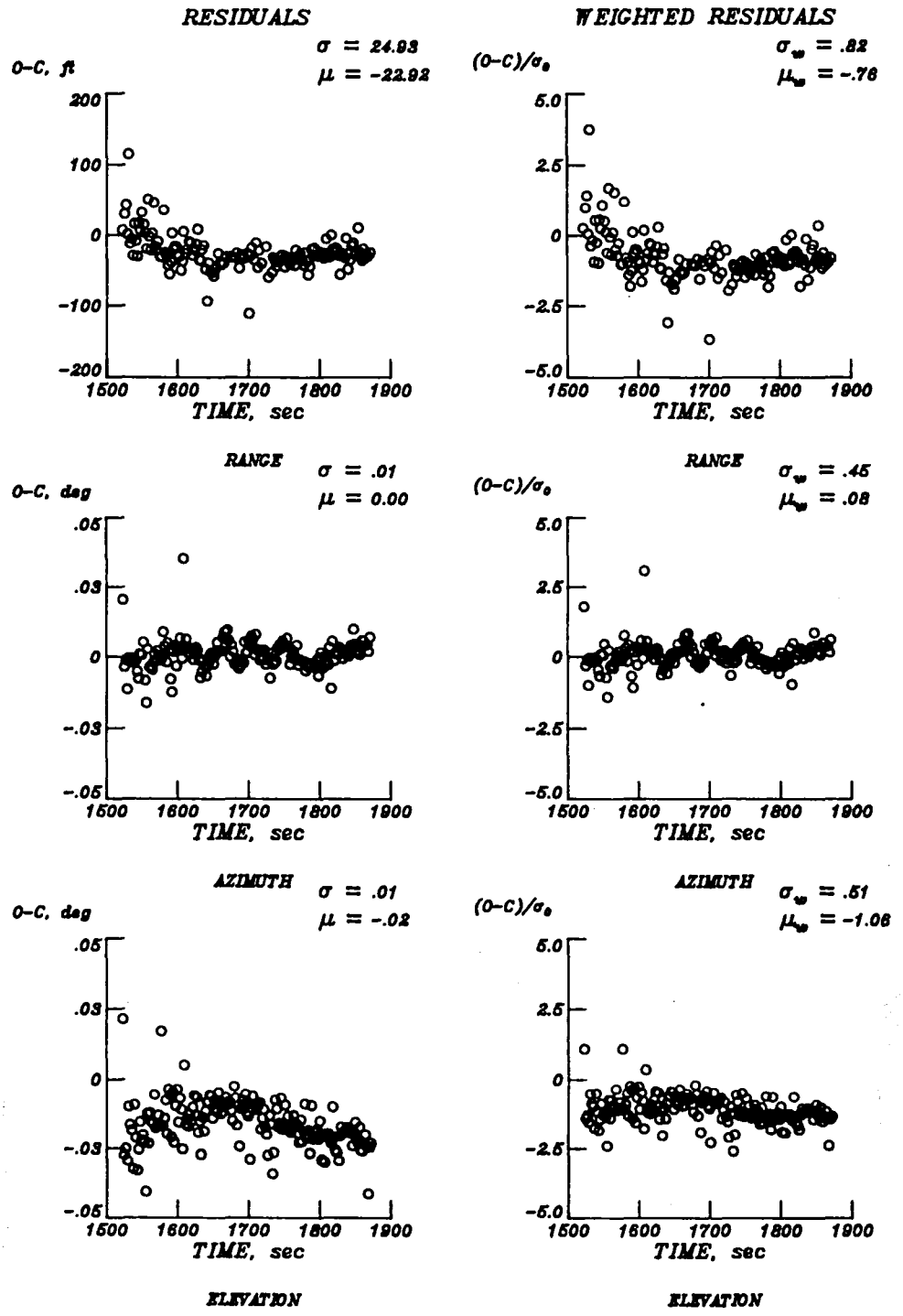


Fig. B-5. *Smoothed residuals versus time for SNFC*

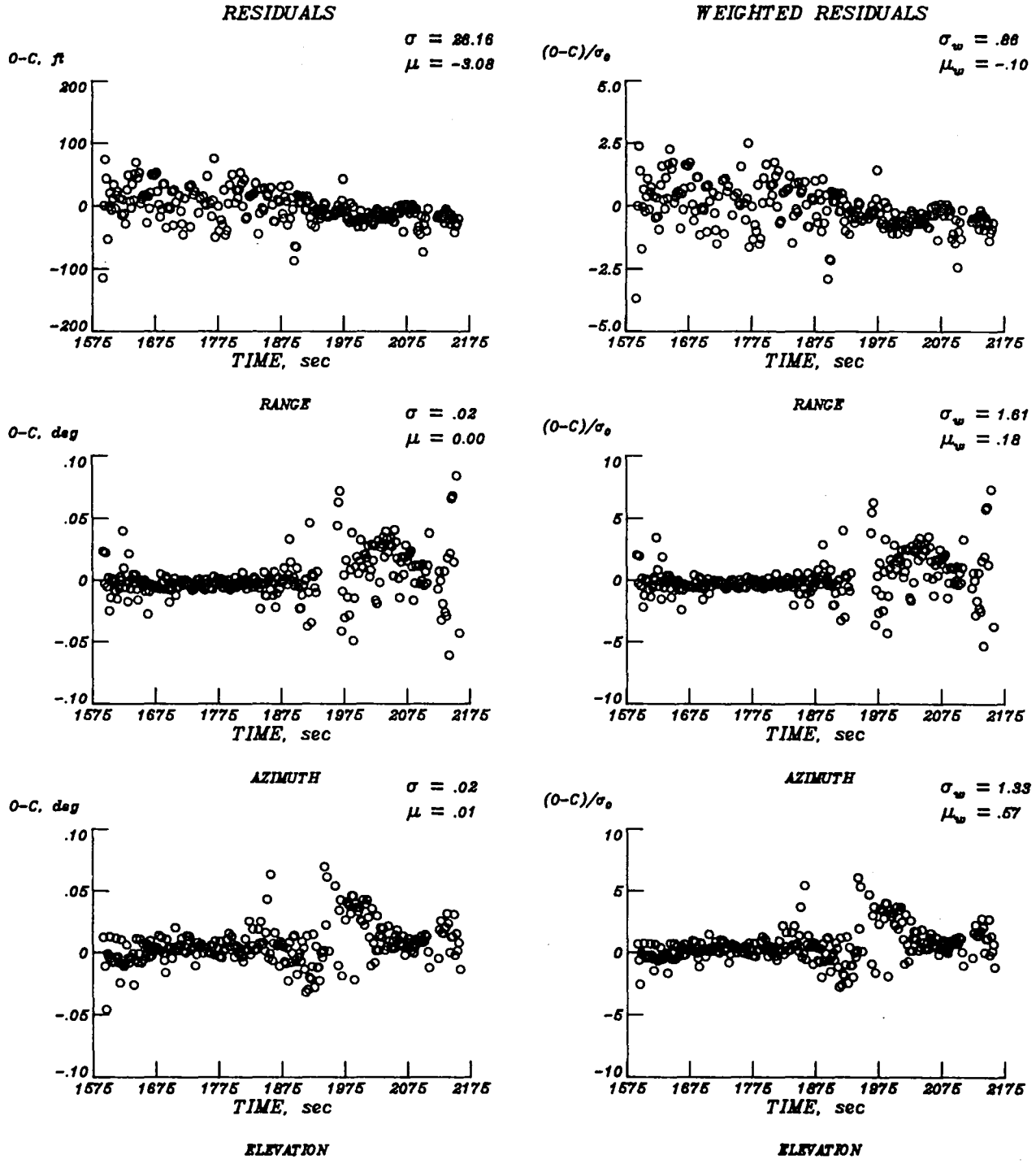


Fig. B-6. *Smoothed residuals versus time for FRCC*

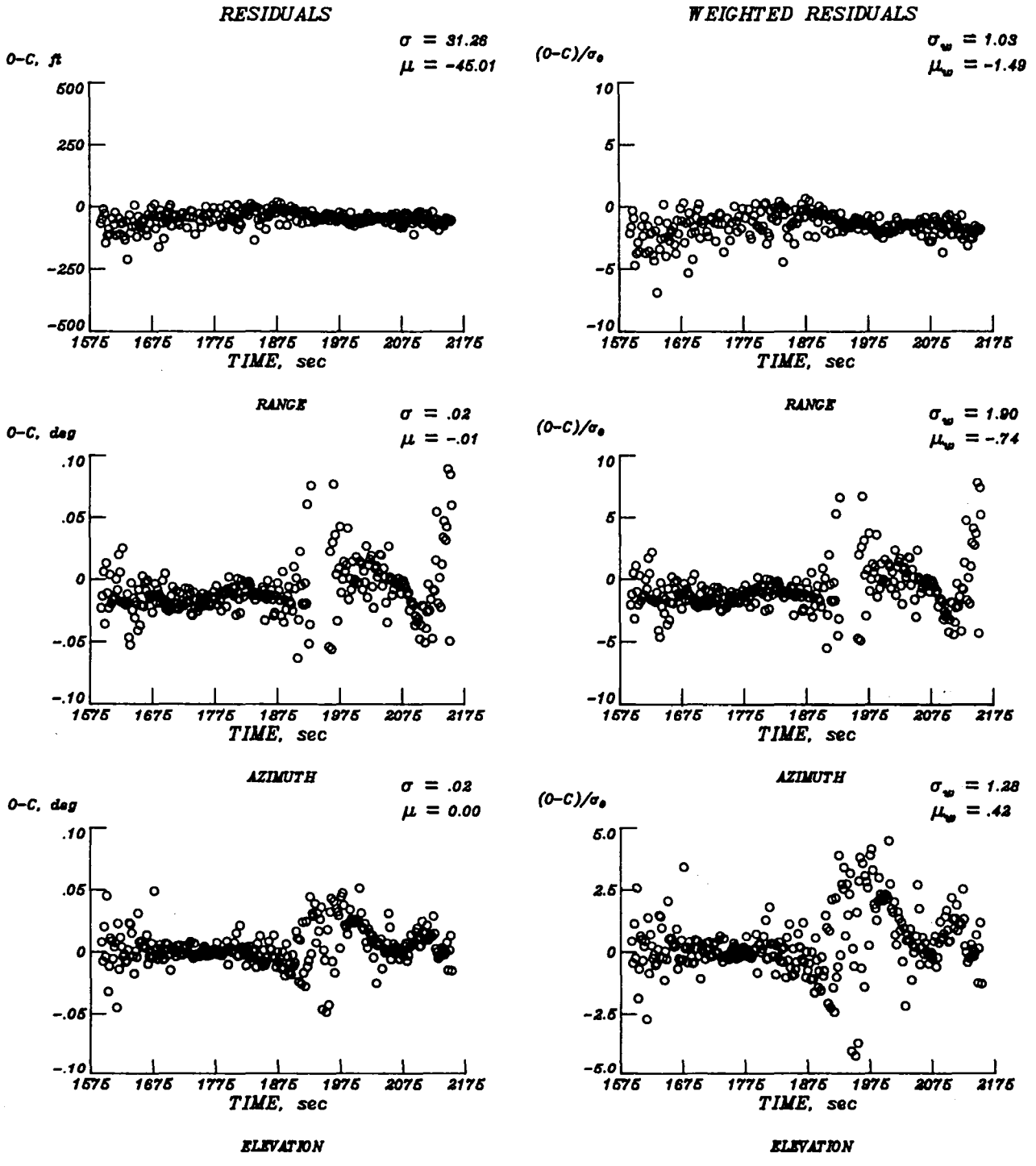


Fig. B-7. *Smoothed residuals versus time for EAFC*

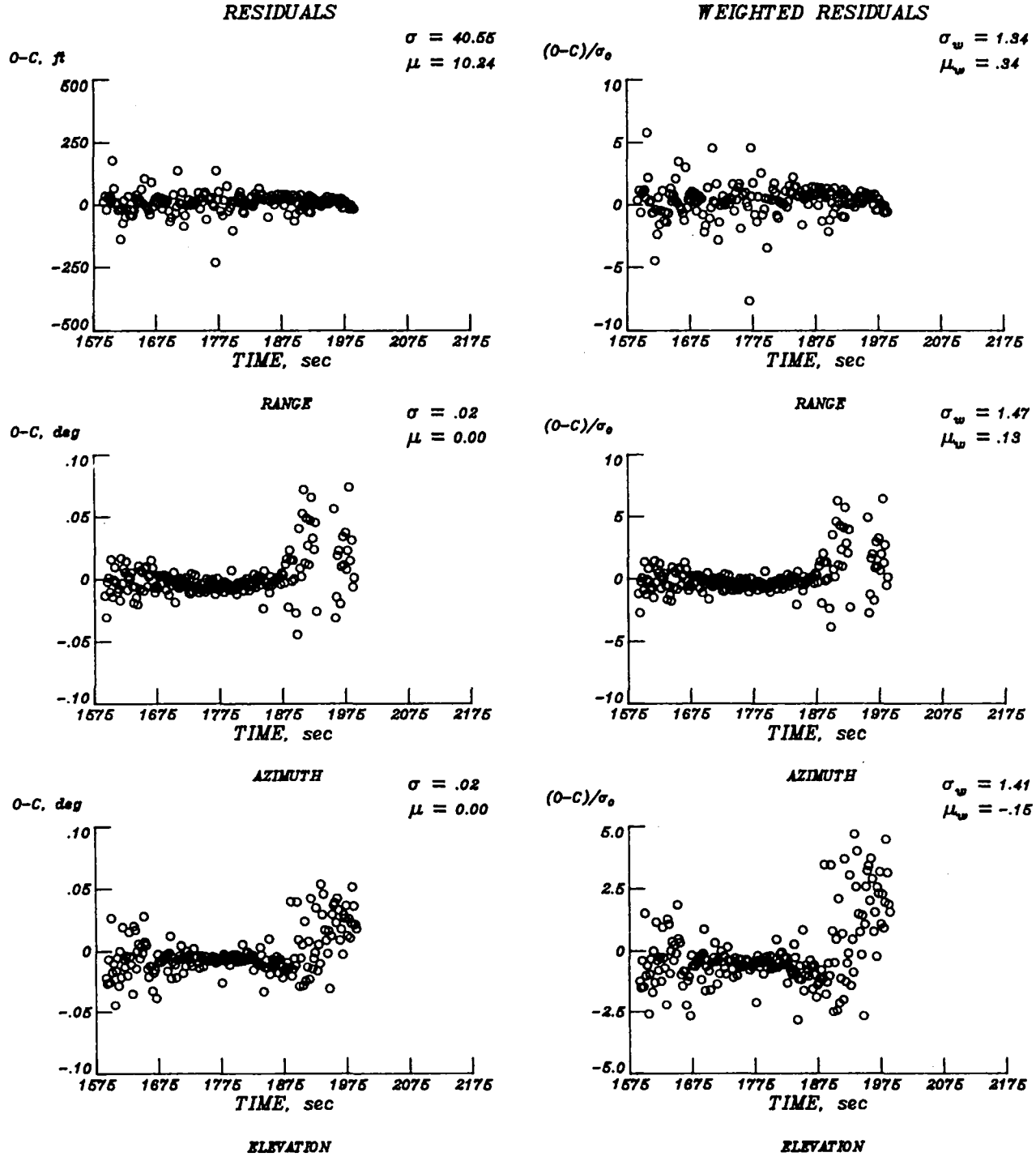


Fig. B-8. *Smoothed residuals versus time for EFFC*

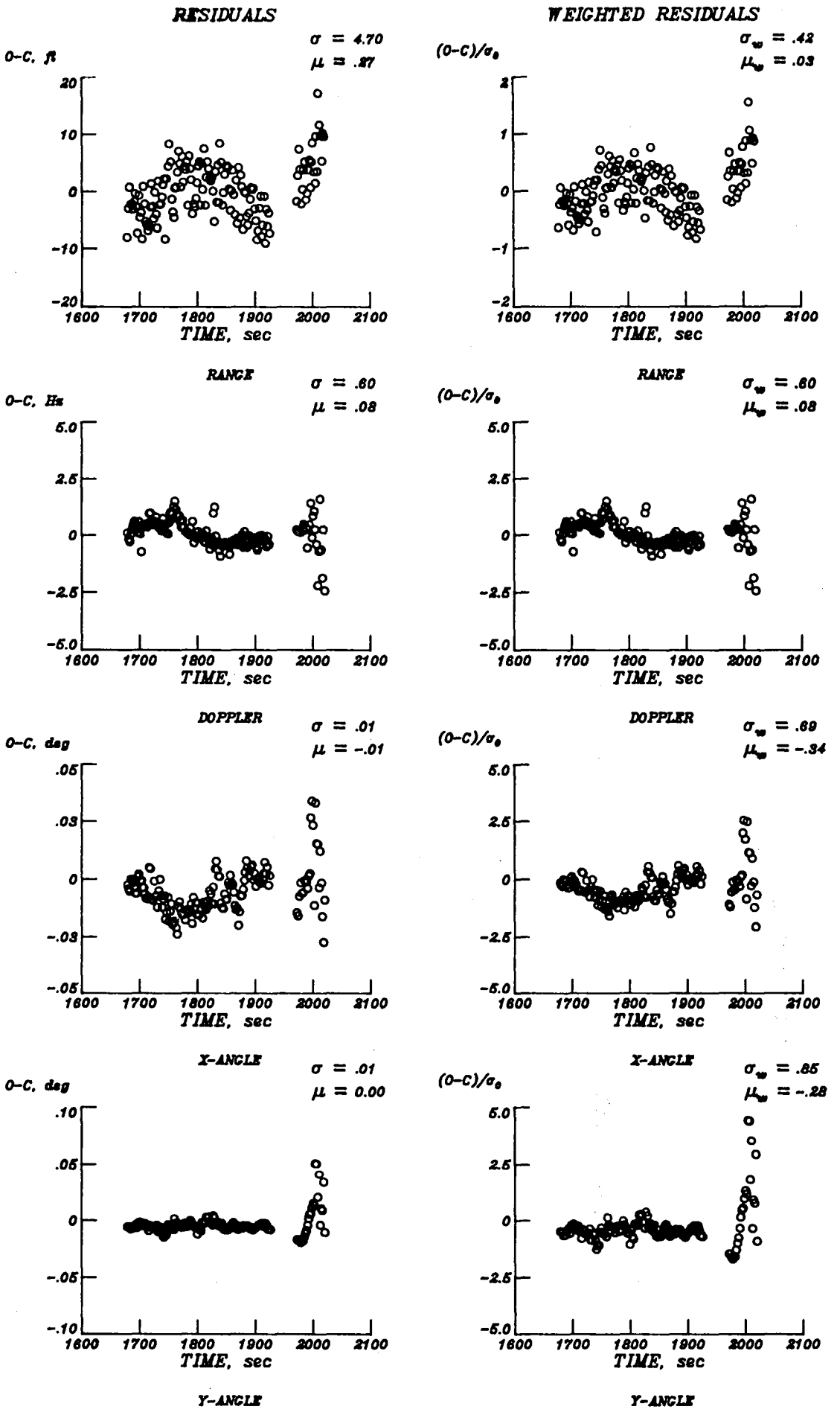


Fig. B-9. *Smoothed residuals versus time for GDSS*

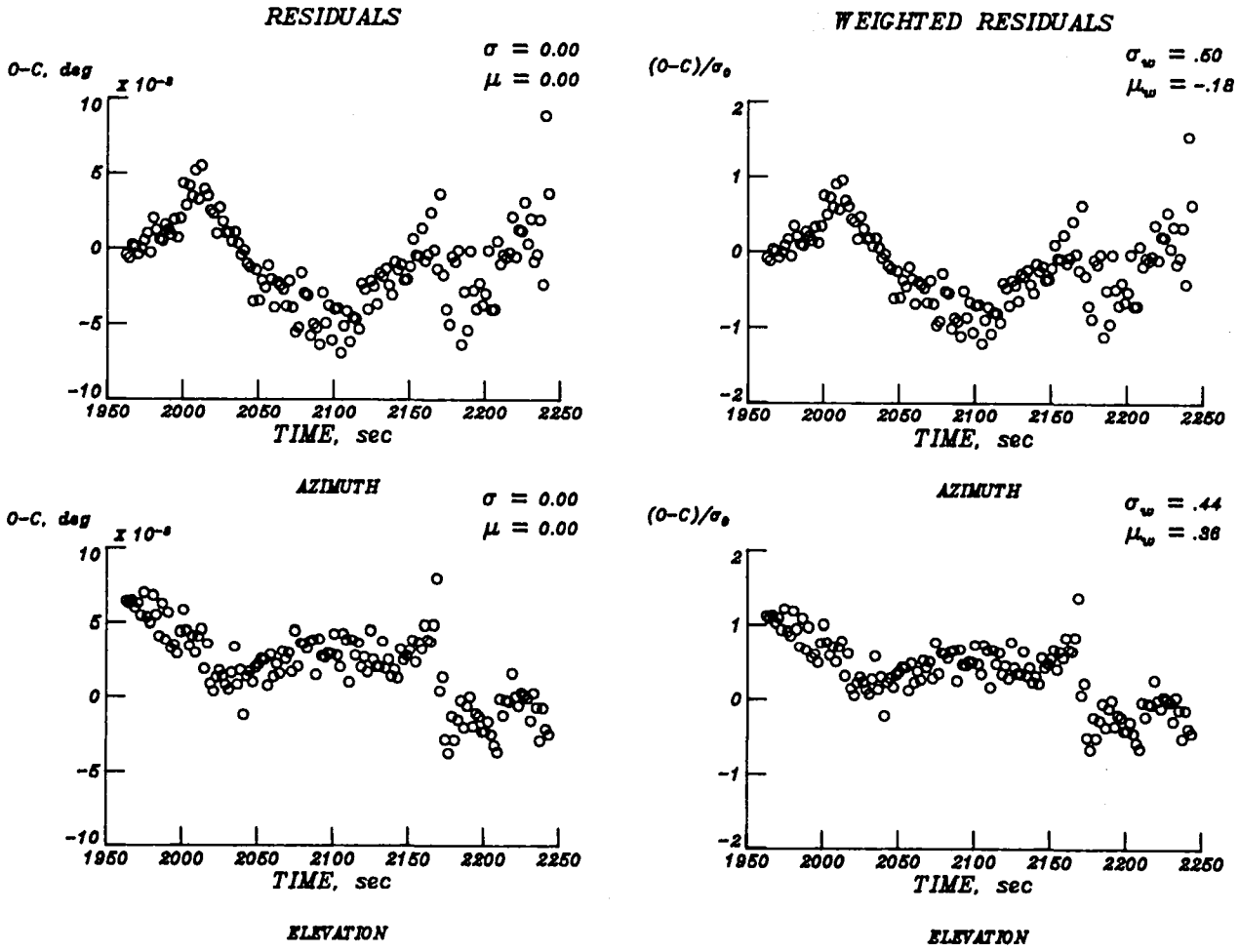


Fig. B-10. *Smoothed residuals versus time for THE01*

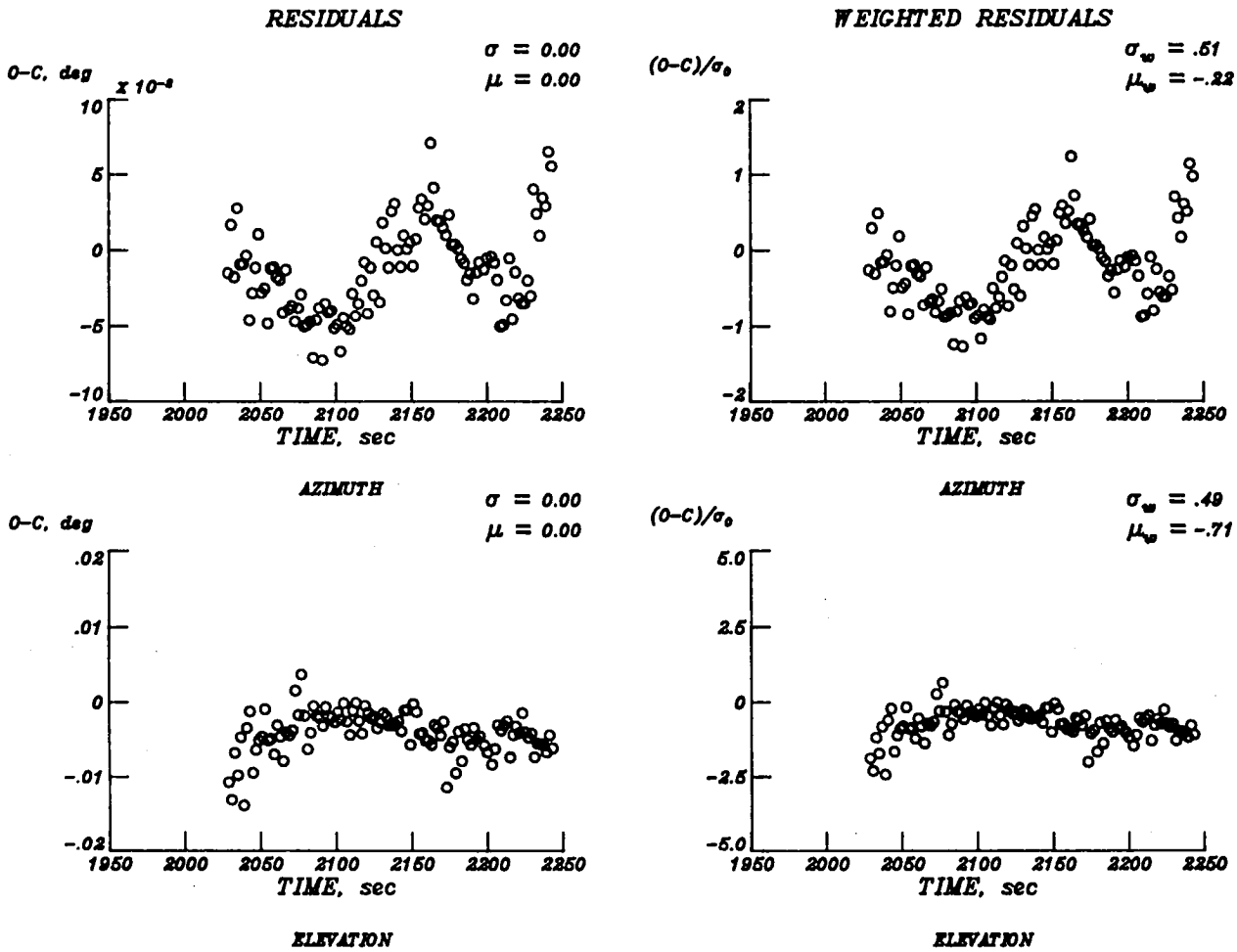


Fig. B-11. *Smoothed residuals versus time for THEO7*

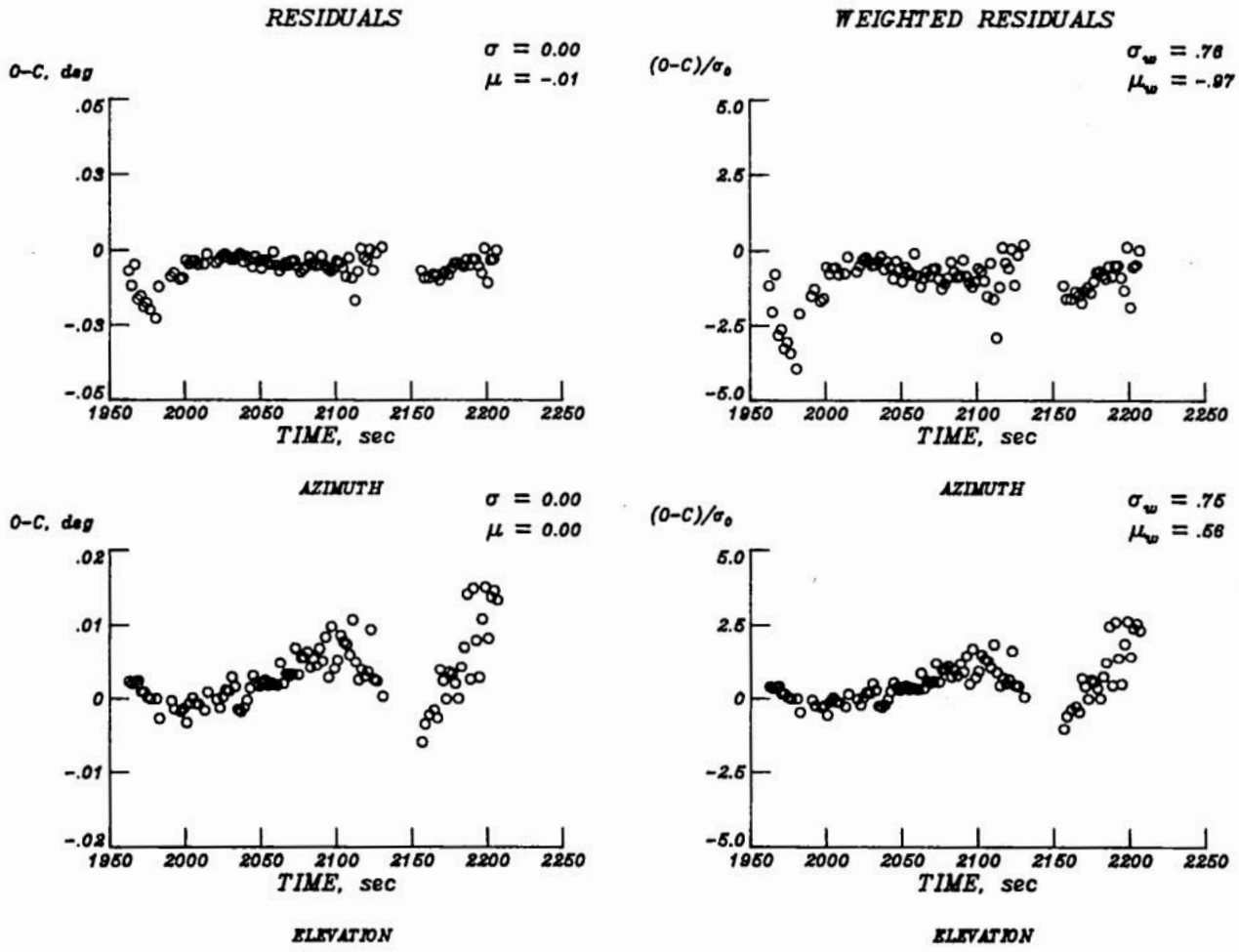


Fig. B-12. *Smoothed residuals versus time for THEOS*

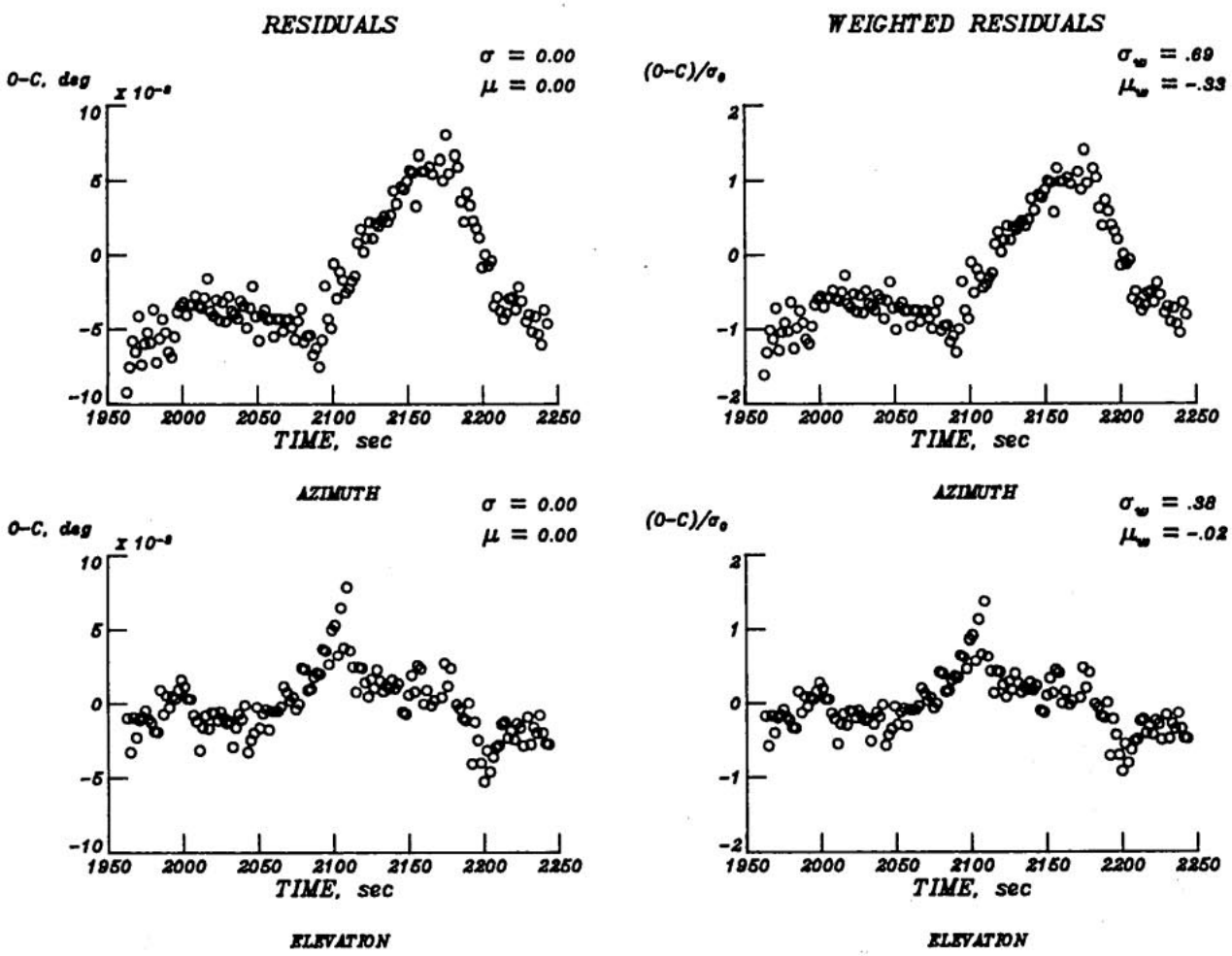


Fig. B-13. *Smoothed residuals versus time for THE09*

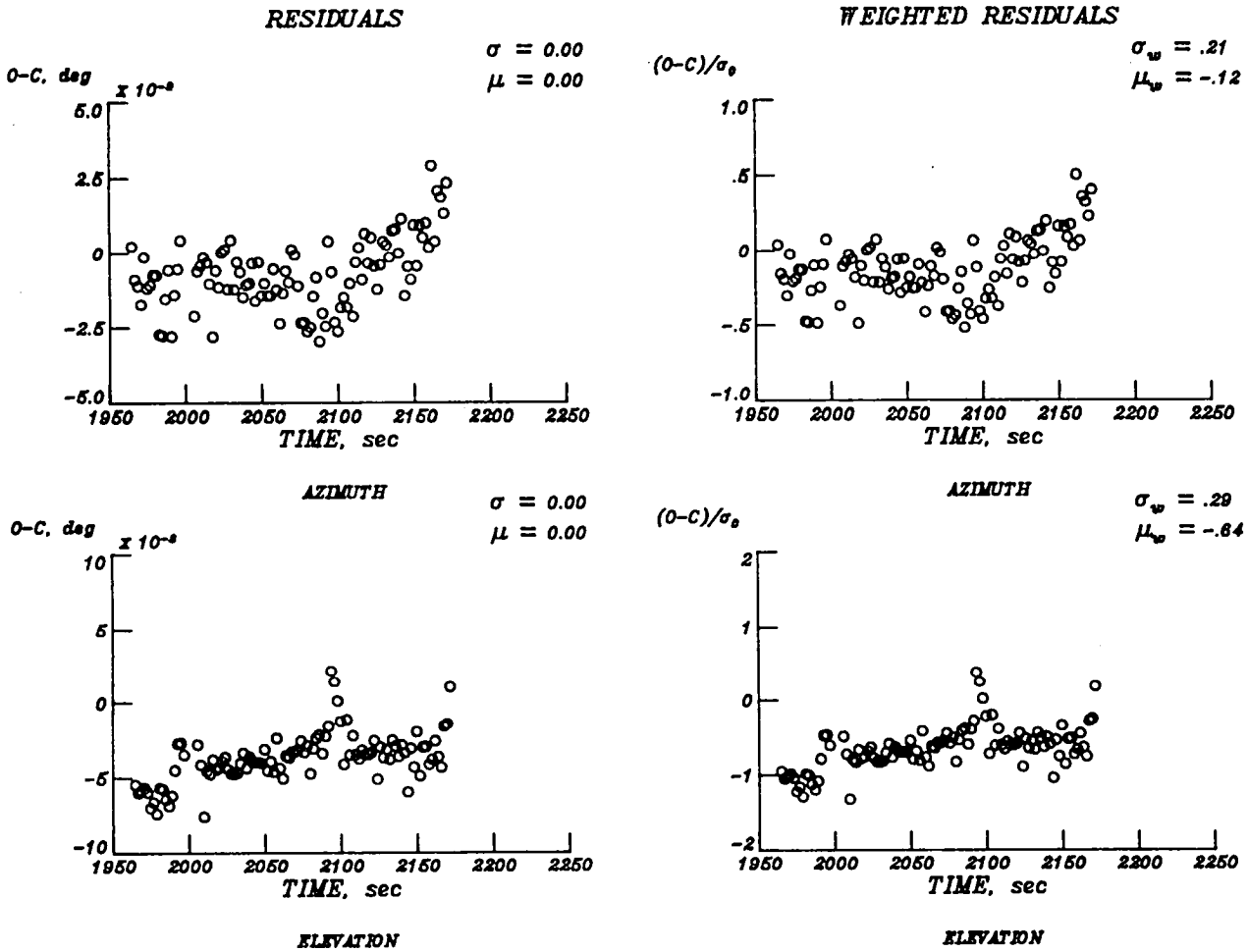


Fig. B-14. *Smoothed residuals versus time for THE15*

APPENDIX C

Listing of ST13BET air relative parameters

@ 2.0 sec

(t, h, V_A, γ_A, ψ_A, σ_A, β_A, α_A, M_A, q_A)

```
*****************************************************************************************
                                LARC "EXTENDED" BET HEADER RECORD                        *
*****************************************************************************************

...DESCRIPTIVE DATA (  48-WORDS )
 ST13BET USING NOAA13(6/84),INERTIAL-BT13M23,NX0681 DYN. DATA.
     840413      2286 STS-13 INERTIAL BET /BT13M23/  (TREF=46890)
   INITIAL CONDITIONS FROM ARHQLKY (ESOLVE) 5-23-84
   IMU NBR 2 EA SEQ 1 (TAPE NL0239)
   S,C-BAND, THEODOLITE, NO PSEUDO DATA
   SOLUTION SET--STATE, ACCELEROMETER SCALE FACTORS

...LABELS AND UNITS FOR DATA ITEMS
 (  1)  TIME          SEC          (  2)  VEL A         FT/SEC       (  3)  GAM A         DEG
 (  4)  HDG A         DEG          (  5)  ALTDE         FEET         (  6)  LATD          DEG
 (  7)  LONG          DEG          (  8)  SIGMAA        DEG          (  9)  BETA A        DEG
 ( 10)  ALPHAA        DEG          ( 11)  YAW E         DEG          ( 12)  PTCH E        DEG
 ( 13)  ROLL E        DEG          ( 14)  U             FT/SEC       ( 15)  V            FT/SEC
 ( 16)  W             FT/SEC       ( 17)  VEL R         FT/SEC       ( 18)  GAM R        DEG
 ( 19)  HDG R         DEG          ( 20)  SIGMAR        DEG          ( 21)  BETA R       DEG
 ( 22)  ALPHAR        DEG          ( 23)  U-WIND        FT/SEC       ( 24)  V-WIND       FT/SEC
 ( 25)  W-WIND        FT/SEC       ( 26)  SIG-VA        FT/SEC       ( 27)  SIG-GA       DEG
 ( 28)  SIG-HA        DEG          ( 29)  SIG-H         FEET         ( 30)  SIG-LA       DEG
 ( 31)  SIG-LO        DEG          ( 32)  SIG-SA        DEG          ( 33)  SIG-BA       DEG
 ( 34)  SIG-AA        DEG          ( 35)  SIG-YE        DEG          ( 36)  SIG-PE       DEG
 ( 37)  SIG-RE        DEG          ( 38)  SIG-U         FT/SEC       ( 39)  SIG-V        FT/SEC
 ( 40)  SIG-W         FT/SEC       ( 41)  MACH A        NONE         ( 42)  MACH R       NONE
 ( 43)  PINF          PSF          ( 44)  TEMP          DEG RANKIN   ( 45)  RHO          SLUGS/FT3
 ( 46)  Q A           PSF          ( 47)  Q R           PSF          ( 48)  PSTAG        PSF
 ( 49)  P             DEG/SEC      ( 50)  Q             DEG/SEC      ( 51)  R            DEG/SEC
 ( 52)  X ACCEL       FT/SEC/SEC   ( 53)  Y ACCEL       FT/SEC/SEC   ( 54)  Z ACCEL      FT/SEC/SEC
 ( 55)  CXB           NONE         ( 56)  CYB           NONE         ( 57)  CZB          NONE
 ( 58)  CL            NONE         ( 59)  CD            NONE         ( 60)  L/D          NONE
 ( 61)  CL-ROLL       NONE         ( 62)  CM-PITCH      NONE         ( 63)  CN-YAW       NONE
 ( 64)  PDOT          DEG/SEC2     ( 65)  QDOT          DEG/SEC2     ( 66)  RDOT         DEG/SEC2

...NUMERICAL DATA
 ISERNO   1  NWDS  66  IUNITS   2
 EPOCH     .46890000E+05  RADE      .20925741E+08  RADP      .20855591E+08  OMEGA     .72921151E-04
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TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
0.0	699611.7	24269.0	-2.036	59.723	-3.209	-.314	37.169	19.131	.011
2.0	697884.3	24271.2	-2.035	59.721	-2.841	-.218	37.360	19.133	.011
4.0	696158.0	24273.3	-2.033	59.718	-2.481	-.127	37.559	19.134	.011
6.0	694432.8	24275.4	-2.032	59.716	-2.115	-.035	37.770	19.136	.011
8.0	692708.7	24277.6	-2.031	59.714	-1.767	.060	37.988	19.138	.011
10.0	690985.7	24279.7	-2.030	59.712	-1.411	.152	38.215	19.139	.011
12.0	689263.8	24281.8	-2.028	59.710	-1.065	.253	38.446	19.141	.011
14.0	687543.1	24284.0	-2.027	59.709	-.716	.356	38.690	19.143	.011
16.0	685823.5	24286.1	-2.026	59.707	-.375	.454	38.940	19.144	.011
18.0	684105.0	24288.2	-2.024	59.706	-.038	.563	39.186	19.146	.011
20.0	682387.8	24290.4	-2.023	59.705	.297	.664	39.402	19.148	.011
22.0	680671.7	24292.5	-2.022	59.704	.631	.775	39.572	19.149	.011
24.0	678956.8	24294.6	-2.020	59.703	.951	.876	39.723	19.151	.011
26.0	677243.1	24296.7	-2.019	59.702	1.274	.984	39.869	19.153	.011
28.0	675530.7	24298.8	-2.017	59.701	1.591	1.104	40.014	19.154	.011
30.0	673819.4	24301.0	-2.016	59.701	1.909	1.213	40.178	19.156	.011
32.0	672109.3	24303.1	-2.015	59.700	2.221	1.326	40.333	19.158	.011
34.0	670400.6	24305.2	-2.013	59.700	2.535	1.443	40.454	19.159	.011
36.0	668693.0	24307.3	-2.012	59.700	2.832	1.554	40.594	19.161	.011
38.0	666986.7	24309.4	-2.010	59.700	3.142	1.672	40.734	19.163	.011
40.0	665281.6	24311.6	-2.009	59.700	3.354	1.707	40.905	19.164	.011
42.0	663577.8	24313.7	-2.007	59.701	3.457	1.640	41.098	19.166	.011
44.0	661875.3	24315.8	-2.006	59.701	3.561	1.578	41.264	19.168	.011
46.0	660174.1	24317.9	-2.004	59.702	3.570	1.431	41.438	19.169	.011
48.0	658474.3	24320.0	-2.003	59.703	3.569	1.268	41.600	19.171	.011
50.0	656775.7	24322.1	-2.001	59.704	3.569	1.109	41.744	19.173	.011
52.0	655078.5	24324.2	-2.000	59.705	3.562	.949	41.898	19.174	.011
54.0	653382.6	24326.3	-1.998	59.706	3.566	.791	42.057	19.176	.011
56.0	651688.0	24328.4	-1.997	59.708	3.562	.632	42.228	19.178	.011
58.0	649994.8	24330.5	-1.995	59.709	3.551	.472	42.397	19.179	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
60.0	648303.0	24332.6	-1.994	59.711	3.541	.307	42.360	19.181	.011
62.0	646612.7	24334.7	-1.992	59.713	3.530	.140	42.301	19.183	.011
64.0	644923.7	24336.8	-1.990	59.715	3.521	-.020	42.260	19.184	.011
66.0	643236.1	24338.9	-1.989	59.717	3.497	-.184	42.231	19.186	.011
68.0	641549.9	24341.0	-1.987	59.719	3.482	-.343	42.200	19.188	.011
70.0	639865.1	24343.1	-1.986	59.722	3.461	-.511	42.182	19.189	.011
72.0	638181.7	24345.2	-1.984	59.724	3.433	-.667	42.171	19.191	.011
74.0	636499.7	24347.3	-1.982	59.727	3.409	-.843	42.175	19.193	.011
76.0	634819.2	24349.3	-1.981	59.730	3.381	-.999	42.179	19.194	.011
78.0	633140.1	24351.4	-1.979	59.733	3.346	-1.166	42.197	19.196	.011
80.0	631462.5	24353.5	-1.977	59.736	3.317	-1.338	42.221	19.197	.011
82.0	629786.4	24355.6	-1.976	59.739	3.263	-1.518	42.259	19.199	.011
84.0	628111.7	24357.7	-1.974	59.744	3.752	-.729	42.378	19.201	.011
86.0	626438.7	24359.8	-1.972	59.747	2.825	.072	42.263	19.202	.011
88.0	624767.3	24361.9	-1.970	59.751	1.216	-.064	42.008	19.204	.011
90.0	623097.5	24364.0	-1.968	59.754	.197	-.152	41.663	19.206	.011
92.0	621429.3	24366.1	-1.966	59.758	-.618	-.251	41.331	19.207	.011
94.0	619762.5	24368.2	-1.965	59.763	-1.283	-.322	41.024	19.209	.011
96.0	618097.3	24370.3	-1.963	59.767	-1.640	-.356	40.761	19.211	.011
98.0	616433.7	24372.4	-1.961	59.771	-1.833	-.359	40.504	19.212	.011
100.0	614771.6	24374.4	-1.959	59.776	-1.782	-.256	40.293	19.214	.011
102.0	613111.1	24376.5	-1.958	59.781	-1.610	-.221	40.093	19.216	.011
104.0	611452.1	24378.5	-1.956	59.786	-1.420	-.154	39.907	19.217	.011
106.0	609794.8	24380.6	-1.954	59.791	-1.222	-.084	39.729	19.219	.011
108.0	608139.0	24382.6	-1.952	59.796	-1.033	-.017	39.556	19.220	.011
110.0	606484.8	24384.7	-1.950	59.801	-.845	.048	39.395	19.222	.011
112.0	604832.2	24386.8	-1.948	59.807	-.656	.112	39.246	19.224	.011
114.0	603181.3	24388.8	-1.947	59.813	-.477	.181	39.102	19.225	.011
116.0	601532.0	24390.9	-1.945	59.818	-.297	.236	38.989	19.227	.011
118.0	599884.3	24392.9	-1.943	59.824	-.122	.296	38.952	19.229	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
120.0	598238.1	24395.0	-1.941	59.831	.041	.351	39.076	19.230	.011
122.0	596593.7	24397.1	-1.939	59.837	.204	.399	39.202	19.232	.011
124.0	594950.9	24399.1	-1.937	59.843	.360	.446	39.337	19.233	.011
126.0	593309.8	24401.1	-1.935	59.850	.482	.383	39.474	19.235	.011
128.0	591670.4	24403.2	-1.933	59.857	.606	.315	39.627	19.237	.011
130.0	590032.6	24405.2	-1.931	59.863	.726	.240	39.780	19.238	.011
132.0	588396.6	24407.2	-1.930	59.870	.849	.177	39.952	19.240	.011
134.0	586762.3	24409.3	-1.927	59.878	.969	.110	40.130	19.241	.011
136.0	585129.8	24411.3	-1.926	59.885	1.094	.113	40.314	19.243	.011
138.0	583498.9	24413.3	-1.924	59.893	1.276	.306	40.497	19.245	.011
140.0	581869.8	24415.4	-1.922	59.900	1.376	.440	40.704	19.246	.011
142.0	580242.5	24417.4	-1.919	59.908	1.112	.226	40.966	19.248	.011
144.0	578616.9	24419.4	-1.917	59.916	.850	.013	41.189	19.249	.011
146.0	576993.2	24421.4	-1.915	59.924	.597	-.191	41.308	19.251	.011
148.0	575371.3	24423.4	-1.913	59.932	.469	-.281	41.292	19.253	.011
150.0	573751.3	24425.4	-1.911	59.941	.417	-.284	41.186	19.254	.011
152.0	572133.1	24427.5	-1.909	59.949	.372	-.280	41.087	19.256	.011
154.0	570516.7	24429.5	-1.907	59.958	.322	-.281	41.004	19.257	.011
156.0	568902.2	24431.5	-1.905	59.967	.274	-.288	40.925	19.259	.011
158.0	567289.4	24433.5	-1.903	59.976	.216	-.284	40.861	19.261	.011
160.0	565678.5	24435.5	-1.901	59.985	.164	-.291	40.803	19.262	.011
162.0	564069.5	24437.5	-1.899	59.994	.101	-.296	40.759	19.264	.011
164.0	562462.3	24439.5	-1.896	60.003	.036	-.307	40.712	19.265	.011
166.0	560857.0	24441.5	-1.894	60.013	-.022	-.300	40.679	19.267	.011
168.0	559253.6	24443.5	-1.892	60.023	-.090	-.315	40.658	19.268	.011
170.0	557652.0	24445.5	-1.890	60.033	-.157	-.316	40.637	19.270	.011
172.0	556052.3	24447.5	-1.888	60.043	-.233	-.326	40.639	19.272	.011
174.0	554454.6	24449.5	-1.886	60.053	-.313	-.331	40.640	19.273	.011
176.0	552858.7	24451.5	-1.883	60.063	-.391	-.345	40.645	19.275	.011
178.0	551264.8	24453.4	-1.881	60.074	-.470	-.346	40.664	19.276	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
180.0	549672.9	24455.4	-1.879	60.084	-.552	-.360	40.692	19.278	.011
182.0	548082.8	24457.4	-1.877	60.095	-.642	-.373	40.731	19.279	.011
184.0	546494.8	24459.4	-1.875	60.106	-.725	-.380	40.772	19.281	.011
186.0	544908.6	24461.4	-1.872	60.117	-.820	-.394	40.822	19.282	.011
188.0	543324.5	24463.3	-1.870	60.128	-.916	-.410	40.882	19.284	.011
190.0	541742.4	24465.3	-1.868	60.140	-1.014	-.420	40.877	19.286	.011
192.0	540162.3	24467.3	-1.865	60.151	-1.036	-.354	40.836	19.287	.011
194.0	538584.3	24469.2	-1.863	60.163	-.924	-.176	40.765	19.289	.011
196.0	537008.2	24471.2	-1.861	60.175	-.817	.014	40.702	19.290	.011
198.0	535434.2	24473.1	-1.858	60.187	-.706	.203	40.649	19.292	.011
200.0	533862.1	24475.1	-1.856	60.199	-.624	.286	40.595	19.293	.011
202.0	532292.2	24477.0	-1.854	60.211	-.594	.195	40.552	19.295	.011
204.0	530724.2	24479.0	-1.851	60.224	-.553	.114	40.522	19.296	.011
206.0	529158.3	24481.0	-1.849	60.236	-.519	.033	40.494	19.298	.011
208.0	527594.5	24482.9	-1.847	60.249	-.492	-.055	40.481	19.299	.011
210.0	526032.8	24484.9	-1.844	60.262	-.463	-.136	40.472	19.301	.011
212.0	524473.1	24486.8	-1.842	60.275	-.436	-.222	40.466	19.303	.011
214.0	522915.5	24488.7	-1.840	60.288	-.409	-.301	40.475	19.304	.011
216.0	521360.0	24490.7	-1.837	60.301	-.357	-.241	40.487	19.306	.011
218.0	519806.7	24492.6	-1.835	60.315	-.269	-.060	40.511	19.307	.011
220.0	518255.5	24494.5	-1.832	60.329	-.193	.118	40.541	19.309	.011
222.0	516706.3	24496.5	-1.830	60.343	-.112	.303	40.575	19.310	.011
224.0	515159.3	24498.4	-1.827	60.356	-.088	.289	40.622	19.312	.011
226.0	513614.5	24500.3	-1.825	60.370	-.115	.053	40.670	19.313	.011
228.0	512071.8	24502.3	-1.822	60.385	-.155	-.188	40.725	19.315	.011
230.0	510531.3	24504.2	-1.820	60.399	-.120	-.146	40.789	19.316	.011
232.0	508993.0	24506.1	-1.817	60.414	-.053	.026	40.854	19.318	.011
234.0	507456.9	24508.0	-1.815	60.429	.010	.200	40.872	19.319	.011
236.0	505923.0	24509.9	-1.812	60.444	.075	.375	40.828	19.321	.011
238.0	504391.3	24511.8	-1.810	60.458	.052	.239	40.795	19.322	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
240.0	502861.8	24513.7	-1.807	60.474	.005	.006	40.769	19.324	.011
242.0	501334.5	24515.6	-1.805	60.489	-.036	-.218	40.751	19.325	.011
244.0	499809.4	24517.5	-1.802	60.505	.184	.053	40.753	19.327	.011
246.0	498286.6	24519.4	-1.800	60.520	.324	.312	40.776	19.328	.011
248.0	496766.1	24521.3	-1.797	60.536	.359	.452	40.819	19.330	.011
250.0	495247.8	24523.2	-1.795	60.552	.339	.379	40.869	19.331	.011
252.0	493731.7	24525.1	-1.792	60.568	.324	.274	40.921	19.333	.011
254.0	492218.1	24527.0	-1.789	60.584	.294	.173	40.828	19.334	.011
256.0	490706.6	24528.9	-1.787	60.601	.264	.075	40.721	19.336	.011
258.0	489197.6	24530.8	-1.784	60.617	.238	-.019	40.616	19.337	.011
260.0	487690.8	24532.6	-1.781	60.634	.204	-.120	40.528	19.339	.011
262.0	486186.3	24534.5	-1.779	60.651	.173	-.218	40.439	19.340	.011
264.0	484684.1	24536.4	-1.776	60.668	.142	-.316	40.363	19.342	.011
266.0	483184.3	24538.2	-1.773	60.685	.133	-.316	40.293	19.343	.011
268.0	481686.8	24540.1	-1.771	60.702	.118	-.299	40.232	19.345	.011
270.0	480191.6	24542.0	-1.768	60.720	.096	-.276	40.175	19.346	.011
272.0	478698.8	24543.9	-1.765	60.738	.084	-.257	40.131	19.348	.011
274.0	477208.3	24545.7	-1.763	60.755	.066	-.239	40.090	19.349	.011
276.0	475720.2	24547.6	-1.760	60.774	.040	-.219	40.067	19.350	.011
278.0	474234.5	24549.4	-1.757	60.792	.015	-.203	40.044	19.352	.011
280.0	472751.2	24551.3	-1.754	60.810	-.015	-.187	40.033	19.353	.011
282.0	471270.3	24553.1	-1.752	60.828	-.052	-.175	40.022	19.355	.011
284.0	469791.8	24555.0	-1.749	60.847	-.080	-.155	40.019	19.356	.011
286.0	468315.7	24556.8	-1.746	60.866	-.120	-.139	40.038	19.358	.011
288.0	466842.0	24558.6	-1.743	60.885	-.165	-.133	40.054	19.359	.011
290.0	465370.8	24560.5	-1.741	60.904	-.215	-.126	40.080	19.361	.011
292.0	463902.0	24562.3	-1.738	60.923	-.267	-.117	40.116	19.362	.011
294.0	462435.6	24564.1	-1.735	60.942	-.305	-.109	40.157	19.363	.011
296.0	460971.7	24566.0	-1.732	60.962	-.371	-.103	40.209	19.365	.011
298.0	459510.3	24567.8	-1.729	60.981	-.424	-.097	40.266	19.366	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
300.0	458051.3	24569.6	-1.727	61.001	-.495	-.095	40.333	19.368	.011
302.0	456594.8	24571.4	-1.724	61.021	-.557	-.093	40.402	19.369	.011
304.0	455140.9	24573.2	-1.721	61.041	-.624	-.091	40.489	19.371	.011
306.0	453689.4	24575.0	-1.718	61.062	-.695	-.096	40.578	19.372	.011
308.0	452240.4	24576.8	-1.715	61.082	-.768	-.098	40.672	19.374	.011
310.0	450793.9	24578.7	-1.712	61.103	-.844	-.104	40.780	19.375	.011
312.0	449350.0	24580.4	-1.709	61.123	-.925	-.109	40.887	19.376	.011
314.0	447908.6	24582.3	-1.706	61.144	-1.016	-.117	41.004	19.378	.011
316.0	446469.8	24584.0	-1.703	61.165	-1.099	-.124	41.036	19.379	.011
318.0	445033.6	24585.8	-1.701	61.187	-1.185	-.132	41.052	19.381	.011
320.0	443599.9	24587.6	-1.697	61.208	-1.282	-.141	40.984	19.382	.011
322.0	442168.9	24589.4	-1.694	61.229	-1.370	-.143	40.907	19.383	.011
324.0	440740.4	24591.2	-1.692	61.251	-1.470	-.156	40.836	19.385	.011
326.0	439314.5	24592.9	-1.689	61.273	-1.571	-.169	40.775	19.386	.011
328.0	437891.3	24594.7	-1.686	61.295	-1.679	-.176	40.722	19.388	.011
330.0	436470.6	24596.5	-1.683	61.317	-1.738	-.300	40.688	19.389	.011
332.0	435052.5	24598.3	-1.680	61.339	-1.700	-.383	40.664	19.390	.011
334.0	433637.0	24600.0	-1.677	61.362	-1.653	-.453	40.645	19.392	.011
336.0	432224.2	24601.8	-1.674	61.385	-1.301	-.225	40.670	19.393	.011
338.0	430814.0	24603.5	-1.671	61.407	-.945	-.002	40.699	19.395	.011
340.0	429406.4	24605.3	-1.667	61.430	-.595	.216	40.737	19.396	.011
342.0	428001.5	24607.1	-1.665	61.453	-.324	.371	40.785	19.397	.011
344.0	426599.4	24608.8	-1.661	61.477	-.309	.282	40.791	19.399	.011
346.0	425199.8	24610.6	-1.658	61.500	-.285	.207	40.778	19.400	.011
348.0	423803.0	24612.3	-1.655	61.524	-.262	.129	40.762	19.401	.011
350.0	422408.9	24614.0	-1.652	61.547	-.249	.052	40.756	19.403	.011
352.0	421017.4	24615.7	-1.649	61.571	-.246	-.025	40.753	19.404	.011
354.0	419628.7	24617.5	-1.646	61.595	-.238	-.105	40.768	19.406	.011
356.0	418242.6	24619.2	-1.643	61.619	-.231	-.186	40.782	19.407	.011
358.0	416859.3	24620.9	-1.640	61.644	-.230	-.277	40.812	19.408	.011

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
360.0	415478.8	24622.6	-1.637	61.669	-.211	-.268	40.840	19.410	.011
362.0	414100.9	24624.4	-1.633	61.693	-.148	-.087	40.874	19.411	.011
364.0	412725.8	24626.1	-1.630	61.718	-.096	.093	40.910	19.412	.011
366.0	411353.6	24627.8	-1.627	61.743	-.032	.271	40.798	19.414	.011
368.0	409984.1	24629.5	-1.624	61.768	-.004	.359	40.670	19.415	.011
370.0	408617.4	24631.2	-1.621	61.793	-.057	.113	40.553	19.416	.011
372.0	407253.5	24632.9	-1.617	61.819	-.116	-.114	40.435	19.418	.011
374.0	405892.4	24634.6	-1.614	61.845	-.149	-.294	40.324	19.419	.011
376.0	404534.0	24636.2	-1.611	61.870	.082	.034	40.240	19.420	.011
378.0	403178.5	24638.0	-1.608	61.896	.224	.286	40.176	19.422	.011
380.0	401825.7	24639.6	-1.605	61.922	.141	.354	40.139	19.423	.011
382.0	400475.8	24641.3	-1.601	61.949	.025	.295	40.111	19.424	.011
384.0	399128.8	24655.1	-1.597	61.932	-.128	.041	40.087	19.541	.011
386.0	397784.5	24655.1	-1.594	61.958	-.288	-.161	40.065	19.673	.012
388.0	396443.1	24655.1	-1.591	61.985	-.450	-.359	40.055	19.807	.013
390.0	395104.6	24655.1	-1.588	62.012	-.559	-.419	40.050	19.944	.013
392.0	393768.9	24655.4	-1.585	62.039	-.469	-.304	40.074	20.081	.014
394.0	392436.1	24656.1	-1.581	62.068	-.397	-.192	40.092	20.218	.015
396.0	391106.2	24656.7	-1.578	62.096	-.335	-.089	40.126	20.356	.015
398.0	389779.1	24657.3	-1.575	62.125	-.275	.013	40.155	20.497	.016
400.0	388455.0	24658.1	-1.572	62.154	-.216	.116	40.200	20.641	.017
402.0	387133.8	24658.2	-1.568	62.181	-.166	.211	40.250	20.782	.018
404.0	385815.5	24658.1	-1.565	62.208	-.112	.307	40.308	20.923	.019
406.0	384500.1	24658.1	-1.562	62.235	-.094	.328	40.361	21.067	.020
408.0	383187.6	24658.1	-1.559	62.262	-.127	.145	40.423	21.214	.021
410.0	381878.0	24658.0	-1.555	62.288	-.160	-.040	40.492	21.360	.022
412.0	380571.4	24657.8	-1.552	62.311	-.197	-.225	40.564	21.497	.024
414.0	379267.8	24657.7	-1.549	62.334	-.222	-.377	40.642	21.636	.025
416.0	377967.2	24657.5	-1.545	62.358	-.097	-.214	40.734	21.778	.026
418.0	376669.5	24657.3	-1.542	62.382	.020	-.048	40.818	21.922	.028

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
420.0	375374.8	24654.0	-1.539	62.406	.135	.118	40.925	22.056	.030
422.0	374083.1	24648.9	-1.536	62.431	.249	.299	40.996	22.185	.031
424.0	372794.4	24643.8	-1.533	62.456	.135	.101	41.029	22.316	.033
426.0	371508.8	24638.7	-1.530	62.482	-.037	-.207	41.023	22.449	.036
428.0	370226.3	24633.7	-1.527	62.507	-.019	-.328	40.953	22.584	.038
430.0	368946.8	24631.9	-1.523	62.537	.126	-.324	40.888	22.714	.040
432.0	367670.3	24630.0	-1.520	62.567	.274	-.322	40.838	22.847	.043
434.0	366396.9	24628.1	-1.517	62.598	.419	-.300	40.790	22.982	.045
436.0	365126.5	24626.3	-1.514	62.628	.622	-.043	40.739	23.119	.048
438.0	363859.1	24624.7	-1.510	62.658	.791	.201	40.696	23.255	.051
440.0	362594.9	24623.7	-1.507	62.686	.774	.255	40.678	23.388	.054
442.0	361333.7	24622.7	-1.503	62.714	.739	.306	40.667	23.522	.058
444.0	360075.6	24621.7	-1.500	62.743	.694	.348	40.661	23.659	.062
446.0	358820.7	24620.8	-1.497	62.772	.617	.358	40.650	23.797	.066
448.0	357568.8	24620.6	-1.493	62.802	.344	.200	40.671	23.923	.070
450.0	356320.0	24621.2	-1.490	62.834	.060	.031	40.692	24.036	.075
452.0	355074.5	24621.7	-1.486	62.867	-.233	-.145	40.713	24.150	.080
454.0	353832.0	24622.3	-1.482	62.899	-.532	-.328	40.728	24.266	.085
456.0	352592.8	24622.9	-1.479	62.932	-.783	-.458	40.752	24.383	.091
458.0	351356.7	24624.5	-1.475	62.965	-.877	-.444	40.791	24.510	.097
460.0	350123.8	24626.5	-1.471	62.999	-.970	-.422	40.819	24.643	.104
462.0	348894.1	24628.5	-1.468	63.032	-1.079	-.417	40.850	24.777	.111
464.0	347667.7	24630.5	-1.464	63.066	-1.187	-.412	40.879	24.913	.119
466.0	346444.4	24632.5	-1.460	63.100	-1.312	-.407	40.919	25.051	.127
468.0	345224.5	24639.0	-1.456	63.139	-1.438	-.403	40.765	25.167	.136
470.0	344007.8	24646.4	-1.452	63.179	-1.571	-.399	40.593	25.279	.146
472.0	342794.5	24653.8	-1.448	63.219	-1.712	-.403	40.414	25.392	.156
474.0	341584.4	24661.1	-1.444	63.259	-1.868	-.414	40.237	25.506	.168
476.0	340377.6	24668.4	-1.439	63.300	-2.034	-.434	40.050	25.621	.180
478.0	339174.2	24674.3	-1.435	63.340	-2.071	-.431	39.864	25.725	.193

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
480.0	337974.1	24680.0	-1.431	63.382	-1.771	-.210	39.696	25.829	.207
482.0	336777.5	24685.7	-1.427	63.423	-1.489	-.018	39.515	25.933	.222
484.0	335584.3	24691.3	-1.423	63.464	-1.279	-.056	39.321	26.038	.238
486.0	334394.5	24696.9	-1.419	63.506	-1.090	-.135	39.122	26.144	.255
488.0	333208.0	24701.4	-1.415	63.544	-.918	-.225	38.999	26.238	.273
490.0	332025.1	24705.5	-1.410	63.582	-.751	-.302	38.952	26.331	.292
492.0	330845.6	24709.6	-1.406	63.621	-.536	-.166	38.950	26.425	.312
494.0	329669.6	24713.8	-1.402	63.659	-.337	-.021	39.121	26.520	.334
496.0	328497.1	24717.9	-1.398	63.698	-.158	.112	39.321	26.615	.357
498.0	327328.3	24731.3	-1.393	63.748	.014	.246	39.499	26.630	.379
500.0	326163.2	24747.4	-1.388	63.800	.168	.368	39.662	26.621	.401
502.0	325001.8	24763.4	-1.383	63.853	.299	.475	39.803	26.612	.425
504.0	323844.2	24779.4	-1.377	63.906	.209	.389	39.953	26.604	.450
506.0	322690.4	24795.3	-1.372	63.959	.095	.282	40.078	26.595	.477
508.0	321540.5	24798.0	-1.368	64.003	-.030	.168	40.179	26.566	.503
510.0	320394.5	24793.1	-1.363	64.042	-.172	.042	40.257	26.524	.530
512.0	319252.5	24788.2	-1.359	64.082	-.336	-.108	40.306	26.483	.558
514.0	318114.6	24783.2	-1.355	64.121	-.516	-.282	40.322	26.442	.588
516.0	316980.8	24778.3	-1.350	64.161	-.504	-.187	40.323	26.401	.619
518.0	315851.2	24773.3	-1.346	64.201	-.325	.186	40.307	26.361	.651
520.0	314725.8	24768.3	-1.341	64.241	-.291	.392	40.265	26.321	.686
522.0	313604.6	24763.4	-1.337	64.281	-.409	.405	40.209	26.281	.721
524.0	312487.8	24758.4	-1.332	64.321	-.570	.394	40.114	26.241	.759
526.0	311375.3	24753.4	-1.327	64.362	-.753	.374	39.987	26.202	.798
528.0	310267.3	24748.3	-1.322	64.402	-1.048	.059	39.810	26.163	.839
530.0	309163.8	24743.3	-1.317	64.443	-1.063	-.108	39.631	26.124	.882
532.0	308064.9	24738.3	-1.312	64.484	-1.015	-.204	39.416	26.086	.927
534.0	306970.6	24733.3	-1.308	64.525	-.959	-.292	39.222	26.047	.975
536.0	305880.9	24728.2	-1.302	64.567	-.645	-.147	39.134	26.009	1.024
538.0	304795.9	24723.2	-1.297	64.608	-.285	.024	39.098	25.972	1.076

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
540.0	303715.8	24718.2	-1.292	64.650	.037	.189	39.098	25.934	1.130
542.0	302640.7	24713.0	-1.286	64.692	.353	.324	39.106	25.897	1.186
544.0	301570.6	24707.8	-1.281	64.734	.647	.443	39.195	25.860	1.245
546.0	300505.7	24702.6	-1.275	64.776	.914	.559	39.353	25.823	1.307
548.0	299446.1	24697.4	-1.269	64.819	1.160	.656	39.569	25.787	1.371
550.0	298391.9	24692.1	-1.263	64.861	1.129	.498	39.887	25.750	1.438
552.0	297343.2	24686.8	-1.257	64.904	1.023	.266	40.285	25.714	1.508
554.0	296300.2	24681.3	-1.251	64.947	.961	.208	40.774	25.679	1.581
556.0	295263.3	24675.8	-1.244	64.990	.943	.237	41.200	25.643	1.657
558.0	294232.5	24670.2	-1.237	65.033	.943	.281	41.391	25.607	1.736
560.0	293208.0	24664.5	-1.230	65.077	.961	.332	41.462	25.572	1.819
562.0	292189.8	24658.8	-1.223	65.120	.976	.368	41.388	25.537	1.905
564.0	291178.2	24653.0	-1.216	65.164	.968	.377	41.131	25.502	1.994
566.0	290173.2	24647.2	-1.208	65.208	.935	.352	40.680	25.468	2.087
568.0	289174.8	24641.5	-1.201	65.252	.885	.322	40.073	25.434	2.183
570.0	288183.2	24652.6	-1.193	65.320	.840	.322	39.434	25.506	2.302
572.0	287198.3	24667.3	-1.184	65.394	.796	.315	39.043	25.602	2.430
574.0	286220.1	24681.8	-1.176	65.467	.785	.335	38.841	25.698	2.564
576.0	285248.8	24696.2	-1.167	65.540	.779	.375	38.790	25.793	2.705
578.0	284284.5	24710.4	-1.158	65.612	.809	.444	38.936	25.889	2.852
580.0	283327.4	24724.5	-1.149	65.685	.830	.500	39.318	25.985	3.006
582.0	282377.7	24738.2	-1.140	65.755	.827	.558	39.908	26.087	3.169
584.0	281435.5	24750.4	-1.130	65.798	.787	.571	40.589	26.273	3.374
586.0	280501.5	24762.3	-1.120	65.842	.664	.548	41.033	26.461	3.589
588.0	279575.8	24774.0	-1.110	65.885	.524	.528	41.199	26.651	3.817
590.0	278658.7	24785.2	-1.099	65.928	.334	.522	41.076	26.842	4.056
592.0	277750.9	24796.0	-1.088	65.971	.037	.471	40.663	27.035	4.307
594.0	276852.5	24806.6	-1.077	66.015	-.343	.425	40.041	27.229	4.572
596.0	275963.6	24817.2	-1.065	66.058	-.773	.402	39.529	27.426	4.849
598.0	275084.5	24823.4	-1.053	66.087	-1.232	.300	39.198	27.576	5.143

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
600.0	274215.7	24828.9	-1.041	66.116	-1.562	.215	39.072	27.724	5.452
602.0	273357.7	24834.1	-1.028	66.144	-1.326	.549	39.215	27.871	5.775
604.0	272511.0	24838.8	-1.015	66.173	-1.359	.558	39.803	28.015	6.110
606.0	271676.1	24842.4	-1.000	66.201	-2.087	.114	40.453	28.114	6.447
608.0	270853.7	24845.2	-.986	66.228	-2.268	.228	40.915	28.212	6.796
610.0	270044.4	24847.7	-.970	66.256	-2.345	.472	41.232	28.308	7.158
612.0	269248.7	24848.9	-.954	66.284	-2.617	.404	41.063	28.393	7.528
614.0	268467.2	24848.0	-.938	66.311	-2.957	.320	40.378	28.407	7.880
616.0	267700.1	24846.8	-.921	66.338	-3.319	.262	39.941	28.421	8.240
618.0	266947.6	24845.5	-.904	66.365	-2.720	.079	39.852	28.435	8.610
620.0	266210.4	24843.6	-.886	66.394	-1.542	.243	39.972	28.447	8.988
622.0	265489.0	24840.1	-.867	66.424	-.568	.422	40.162	28.449	9.368
624.0	264784.1	24835.8	-.849	66.454	-.071	.376	40.328	28.448	9.752
626.0	264095.9	24831.2	-.829	66.486	.245	.288	40.422	28.446	10.142
628.0	263425.2	24826.2	-.809	66.518	.564	.275	40.361	28.443	10.537
630.0	262772.1	24820.8	-.788	66.550	.828	.307	40.128	28.437	10.934
632.0	262137.1	24812.1	-.768	66.586	.978	.330	39.850	28.373	11.280
634.0	261520.3	24803.3	-.747	66.623	1.060	.361	39.657	28.310	11.626
636.0	260922.3	24794.4	-.725	66.660	1.001	.369	39.632	28.249	11.971
638.0	260343.2	24786.0	-.703	66.701	.844	.379	39.751	28.215	12.140
640.0	259783.6	24776.5	-.681	66.739	.580	.398	39.974	28.156	12.481
642.0	259243.9	24766.7	-.658	66.777	.147	.322	40.209	28.099	12.820
644.0	258724.4	24756.6	-.634	66.815	-.191	.248	40.362	28.043	13.154
646.0	258225.9	24746.2	-.610	66.854	-.459	.295	40.388	27.989	13.482
648.0	257748.8	24735.6	-.585	66.893	-.894	.348	40.282	27.937	13.804
650.0	257293.3	24724.9	-.560	66.933	-2.548	1.355	40.198	27.886	14.118
652.0	256860.1	24713.7	-.534	66.971	-7.543	.971	40.259	27.837	14.422
654.0	256449.7	24702.2	-.508	67.008	-13.221	.663	40.394	27.790	14.717
656.0	256062.4	24690.2	-.481	67.042	-19.023	.561	40.462	27.744	14.999
658.0	255697.9	24677.0	-.456	67.076	-24.918	.546	40.359	27.699	15.258

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
660.0	255355.6	24663.7	-.431	67.107	-31.021	.538	40.215	27.655	15.504
662.0	255034.3	24650.4	-.407	67.136	-37.351	.516	40.038	27.613	15.738
664.0	254732.7	24638.2	-.385	67.165	-43.822	.455	39.877	27.587	15.843
666.0	254449.0	24624.9	-.366	67.189	-50.260	.448	39.819	27.548	16.060
668.0	254181.3	24611.7	-.349	67.212	-56.665	.288	39.850	27.510	16.265
670.0	253926.8	24598.3	-.335	67.232	-61.507	-.367	39.871	27.473	16.460
672.0	253684.1	24584.9	-.322	67.252	-64.010	-.029	39.792	27.438	16.646
674.0	253452.4	24571.6	-.310	67.272	-66.256	.136	39.700	27.404	16.823
676.0	253230.6	24559.0	-.299	67.292	-68.399	.123	39.665	27.380	16.901
678.0	253017.9	24545.6	-.289	67.311	-70.332	.125	39.729	27.348	17.068
680.0	252813.4	24532.1	-.280	67.329	-71.929	.054	39.846	27.315	17.228
682.0	252616.5	24518.5	-.272	67.347	-73.300	.042	39.968	27.284	17.382
684.0	252426.4	24504.7	-.265	67.365	-74.498	.030	40.048	27.253	17.530
686.0	252242.7	24490.8	-.258	67.382	-75.433	.040	40.080	27.222	17.673
688.0	252064.8	24476.9	-.251	67.400	-76.269	.056	40.062	27.192	17.812
690.0	251892.2	24463.5	-.245	67.418	-76.891	-.003	40.018	27.170	17.870
692.0	251724.6	24449.6	-.240	67.435	-77.363	.016	39.966	27.141	18.002
694.0	251561.8	24435.6	-.235	67.452	-77.844	.013	39.931	27.112	18.130
696.0	251403.3	24421.6	-.230	67.469	-78.317	.003	39.899	27.083	18.254
698.0	251248.8	24407.5	-.226	67.486	-78.770	-.018	39.880	27.055	18.375
700.0	251098.1	24393.4	-.222	67.503	-79.199	-.051	39.884	27.027	18.493
702.0	250950.8	24379.2	-.218	67.520	-79.593	-.096	39.921	26.999	18.607
704.0	250806.6	24365.4	-.215	67.537	-79.847	-.083	39.952	26.978	18.653
706.0	250665.4	24351.1	-.211	67.554	-80.051	-.067	39.970	26.951	18.764
708.0	250526.8	24336.6	-.209	67.570	-80.222	-.084	39.992	26.924	18.871
710.0	250390.8	24322.2	-.206	67.586	-80.342	-.118	39.986	26.897	18.977
712.0	250257.0	24307.7	-.203	67.603	-80.303	-.078	39.949	26.870	19.080
714.0	250125.5	24293.2	-.201	67.620	-80.233	-.068	39.888	26.844	19.181
716.0	249996.1	24278.8	-.199	67.636	-80.140	-.090	39.842	26.817	19.281
718.0	249868.8	24264.3	-.196	67.653	-79.927	-.084	39.838	26.791	19.379

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
720.0	249743.5	24250.1	-.194	67.670	-79.670	-.048	39.877	26.771	19.416
722.0	249620.3	24235.5	-.192	67.686	-79.449	-.044	39.910	26.745	19.512
724.0	249499.2	24220.8	-.189	67.703	-79.267	.031	39.943	26.719	19.605
726.0	249380.1	24206.1	-.187	67.720	-79.269	.005	39.966	26.694	19.698
728.0	249263.0	24191.1	-.185	67.737	-79.219	.006	39.976	26.676	19.798
730.0	249147.7	24176.1	-.183	67.754	-79.147	-.003	39.968	26.658	19.895
732.0	249034.1	24160.9	-.181	67.771	-79.071	.050	39.930	26.640	19.991
734.0	248922.2	24145.9	-.180	67.788	-79.051	.088	39.864	26.622	20.085
736.0	248811.9	24130.8	-.178	67.805	-79.088	.174	39.838	26.605	20.178
738.0	248703.2	24116.1	-.176	67.822	-79.536	.063	39.844	26.588	20.212
740.0	248595.4	24100.9	-.175	67.839	-79.930	-.000	39.881	26.570	20.302
742.0	248488.4	24085.6	-.175	67.855	-80.176	.023	39.915	26.552	20.391
744.0	248381.9	24070.3	-.175	67.872	-80.406	.057	39.941	26.534	20.479
746.0	248275.7	24054.9	-.175	67.889	-80.652	.072	39.948	26.516	20.566
748.0	248169.4	24039.5	-.175	67.905	-80.910	.081	39.952	26.498	20.652
750.0	248062.9	24024.1	-.175	67.922	-81.207	.059	39.932	26.479	20.737
752.0	247955.9	24008.7	-.176	67.938	-81.560	-.026	39.891	26.461	20.823
754.0	247847.9	23993.5	-.178	67.955	-81.790	-.029	39.842	26.443	20.909
756.0	247738.8	23978.2	-.180	67.972	-81.985	-.038	39.810	26.425	20.995
758.0	247628.2	23963.0	-.182	67.990	-82.144	-.049	39.825	26.407	21.082
760.0	247515.9	23947.6	-.184	68.006	-82.168	-.146	39.864	26.389	21.171
762.0	247401.7	23932.1	-.186	68.023	-81.876	-.117	39.895	26.371	21.260
764.0	247285.8	23916.5	-.188	68.040	-81.537	-.118	39.913	26.353	21.351
766.0	247168.2	23900.8	-.190	68.056	-81.148	-.145	39.923	26.334	21.444
768.0	247049.1	23885.0	-.192	68.073	-80.617	-.151	39.924	26.316	21.539
770.0	246928.5	23869.6	-.194	68.090	-80.057	.054	40.368	26.297	21.637
772.0	246806.8	23853.0	-.196	68.105	-80.088	-.048	40.639	26.278	21.736
774.0	246683.8	23837.0	-.198	68.121	-80.044	-.148	39.463	26.255	21.830
776.0	246559.2	23821.1	-.200	68.139	-79.766	-.113	39.687	26.236	21.950
778.0	246433.0	23804.2	-.202	68.155	-79.470	-.117	40.347	26.213	22.062

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
780.0	246305.4	23787.5	-.203	68.171	-79.104	-.108	39.894	26.191	22.176
782.0	246176.5	23771.2	-.205	68.187	-78.332	.042	39.399	26.168	22.292
784.0	246046.7	23755.2	-.206	68.204	-78.834	-.329	39.118	26.146	22.410
786.0	245915.4	23739.0	-.209	68.221	-78.864	-.138	39.076	26.123	22.530
788.0	245782.3	23722.2	-.211	68.235	-78.391	-.308	39.331	26.100	22.652
790.0	245648.0	23704.6	-.212	68.249	-77.400	-.252	39.760	26.076	22.774
792.0	245512.8	23686.5	-.213	68.262	-75.717	-.490	40.041	26.051	22.897
794.0	245378.1	23668.3	-.211	68.276	-73.500	-.098	40.011	26.026	23.019
796.0	245245.1	23650.2	-.209	68.290	-72.347	-.052	39.757	26.002	23.141
798.0	245114.2	23632.4	-.207	68.305	-71.770	-.109	39.510	25.978	23.261
800.0	244985.6	23614.7	-.204	68.319	-71.335	-.142	39.327	25.954	23.378
802.0	244859.3	23597.0	-.201	68.334	-70.839	-.177	39.176	25.930	23.494
804.0	244735.4	23579.4	-.199	68.349	-70.189	-.135	39.046	25.906	23.607
806.0	244614.1	23561.9	-.195	68.364	-69.665	-.114	39.001	25.882	23.718
808.0	244495.6	23544.9	-.192	68.380	-69.139	-.141	39.007	25.859	23.833
810.0	244380.1	23527.3	-.188	68.395	-68.489	-.062	39.049	25.836	23.931
812.0	244267.9	23509.6	-.184	68.411	-68.073	-.066	39.059	25.812	24.031
814.0	244159.3	23491.7	-.180	68.426	-67.810	-.057	39.038	25.788	24.127
816.0	244054.2	23473.9	-.176	68.441	-67.700	-.018	39.001	25.764	24.218
818.0	243952.6	23456.6	-.172	68.457	-67.609	-.020	38.971	25.741	24.316
820.0	243854.4	23438.8	-.168	68.472	-67.496	.027	38.946	25.718	24.391
822.0	243759.6	23420.9	-.164	68.487	-67.418	.049	38.953	25.695	24.470
824.0	243668.1	23402.8	-.160	68.502	-67.350	.068	38.981	25.671	24.545
826.0	243580.0	23385.2	-.156	68.518	-67.268	.085	39.016	25.648	24.617
828.0	243495.1	23367.0	-.152	68.532	-67.486	.185	39.011	25.624	24.683
830.0	243413.4	23348.9	-.149	68.547	-68.043	.111	38.940	25.601	24.746
832.0	243334.2	23331.4	-.146	68.562	-68.560	.108	38.811	25.578	24.808
834.0	243256.9	23313.6	-.144	68.577	-69.150	.084	38.699	25.555	24.865
836.0	243181.1	23295.7	-.143	68.592	-69.784	.021	38.687	25.531	24.920
838.0	243106.2	23278.1	-.142	68.606	-70.126	.009	38.730	25.509	24.976

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
840.0	243032.0	23260.0	-.141	68.620	-70.393	.038	38.755	25.485	25.029
842.0	242958.2	23241.8	-.141	68.633	-70.652	-.002	38.760	25.461	25.081
844.0	242884.6	23223.6	-.141	68.647	-70.792	.003	38.730	25.438	25.133
846.0	242810.9	23205.8	-.142	68.661	-70.942	-.021	38.689	25.415	25.188
848.0	242736.9	23187.7	-.142	68.674	-70.940	-.097	38.663	25.388	25.238
850.0	242662.4	23169.5	-.143	68.687	-70.636	-.049	38.654	25.362	25.287
852.0	242587.6	23151.4	-.143	68.701	-70.323	-.046	38.662	25.335	25.334
854.0	242512.4	23133.1	-.144	68.714	-70.004	-.065	38.679	25.308	25.380
856.0	242437.0	23114.8	-.144	68.727	-69.648	-.096	38.693	25.281	25.426
858.0	242361.5	23096.5	-.144	68.740	-69.192	-.099	38.700	25.254	25.471
860.0	242286.0	23078.1	-.144	68.754	-68.653	-.043	38.691	25.227	25.517
862.0	242210.6	23059.8	-.144	68.768	-68.227	-.043	38.659	25.201	25.564
864.0	242135.6	23041.5	-.144	68.782	-67.758	-.054	38.626	25.174	25.611
866.0	242061.0	23023.2	-.143	68.796	-67.374	-.005	38.615	25.147	25.658
868.0	241986.9	23004.9	-.143	68.810	-67.104	.002	38.641	25.120	25.706
870.0	241913.3	22986.6	-.142	68.824	-66.884	.052	38.733	25.093	25.754
872.0	241840.1	22968.1	-.142	68.839	-66.717	.086	38.830	25.067	25.787
874.0	241767.5	22949.6	-.141	68.853	-66.657	.116	38.928	25.040	25.830
876.0	241695.4	22930.9	-.141	68.867	-66.903	.118	39.024	25.013	25.872
878.0	241623.4	22912.2	-.141	68.881	-67.330	.044	39.083	24.987	25.914
880.0	241551.1	22893.4	-.142	68.895	-67.722	.023	39.109	24.960	25.955
882.0	241478.2	22874.6	-.143	68.909	-68.031	.099	39.113	24.932	25.999
884.0	241404.3	22855.8	-.145	68.923	-68.467	.112	39.129	24.905	26.043
886.0	241328.9	22836.9	-.147	68.936	-69.053	.039	39.170	24.878	26.088
888.0	241251.5	22818.0	-.150	68.949	-69.363	.026	39.230	24.851	26.137
890.0	241171.9	22799.0	-.153	68.962	-69.658	.046	39.281	24.823	26.188
892.0	241089.6	22779.9	-.157	68.975	-70.071	-.019	39.345	24.796	26.244
894.0	241004.4	22760.7	-.161	68.987	-70.443	-.061	39.434	24.768	26.287
896.0	240915.7	22741.0	-.165	68.999	-70.510	-.051	39.494	24.738	26.359
898.0	240823.5	22721.6	-.170	69.011	-70.426	.056	39.503	24.709	26.423

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
900.0	240727.7	22701.8	-.175	69.023	-70.463	-.053	39.494	24.680	26.492
902.0	240628.2	22682.3	-.180	69.035	-70.250	-.053	39.484	24.650	26.575
904.0	240524.8	22662.5	-.185	69.047	-70.027	-.074	39.484	24.621	26.645
906.0	240417.6	22642.9	-.190	69.059	-69.771	-.096	39.515	24.591	26.729
908.0	240306.7	22623.3	-.195	69.071	-69.477	-.111	39.591	24.561	26.819
910.0	240192.0	22603.3	-.199	69.082	-69.130	-.144	39.712	24.531	26.911
912.0	240073.6	22583.3	-.204	69.094	-68.702	-.156	39.832	24.500	27.010
914.0	239951.7	22563.3	-.209	69.106	-68.176	-.162	39.919	24.469	27.120
916.0	239826.6	22543.1	-.213	69.118	-67.524	-.115	39.929	24.439	27.210
918.0	239698.6	22522.5	-.216	69.130	-67.023	-.078	39.896	24.408	27.331
920.0	239567.8	22502.3	-.220	69.142	-66.623	-.111	39.876	24.377	27.446
922.0	239434.4	22482.0	-.224	69.154	-66.177	-.128	39.890	24.346	27.566
924.0	239298.6	22461.6	-.227	69.166	-65.601	-.086	39.934	24.314	27.699
926.0	239160.5	22441.1	-.230	69.178	-64.975	-.022	39.966	24.283	27.814
928.0	239020.6	22420.5	-.232	69.191	-64.438	-.054	39.997	24.252	27.933
930.0	238879.1	22399.3	-.234	69.202	-64.064	-.036	40.064	24.219	28.073
932.0	238736.2	22378.4	-.236	69.214	-63.742	-.038	40.053	24.188	28.206
934.0	238591.9	22357.6	-.238	69.226	-63.397	-.005	40.017	24.156	28.342
936.0	238446.4	22336.5	-.239	69.238	-63.057	.031	40.014	24.124	28.479
938.0	238299.9	22315.4	-.241	69.250	-62.753	.052	40.050	24.092	28.619
940.0	238152.5	22294.0	-.242	69.262	-62.479	.082	40.076	24.059	28.759
942.0	238004.3	22272.8	-.243	69.274	-62.274	.110	40.055	24.027	28.901
944.0	237855.3	22251.4	-.245	69.285	-62.172	.125	40.023	23.995	29.045
946.0	237705.3	22230.0	-.246	69.297	-62.114	.178	40.012	23.963	29.190
948.0	237554.5	22208.6	-.248	69.308	-62.208	.199	40.047	23.930	29.338
950.0	237402.6	22186.8	-.249	69.319	-62.465	.191	40.143	23.898	29.486
952.0	237249.5	22164.8	-.251	69.329	-62.708	.111	40.181	23.864	29.636
954.0	237095.2	22142.5	-.253	69.339	-62.859	.146	40.142	23.831	29.788
956.0	236939.4	22120.2	-.255	69.348	-63.149	.067	40.138	23.798	29.942
958.0	236781.8	22097.8	-.258	69.357	-63.192	.117	40.149	23.764	30.110

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
960.0	236622.2	22075.3	-.261	69.365	-63.253	.068	40.163	23.731	30.263
962.0	236460.6	22052.5	-.264	69.373	-63.029	.031	40.156	23.697	30.419
964.0	236297.2	22029.5	-.266	69.381	-62.666	.030	40.022	23.663	30.578
966.0	236132.3	22006.4	-.268	69.388	-62.325	.017	39.853	23.623	30.741
968.0	235965.9	21983.7	-.271	69.396	-62.006	-.011	39.717	23.580	30.884
970.0	235798.0	21960.9	-.273	69.404	-61.666	-.033	39.669	23.537	31.027
972.0	235629.0	21937.8	-.274	69.411	-61.326	-.069	39.713	23.494	31.173
974.0	235459.2	21914.4	-.275	69.418	-60.693	-.060	39.683	23.451	31.319
976.0	235289.1	21890.9	-.275	69.425	-60.038	-.038	39.487	23.407	31.466
978.0	235119.3	21867.4	-.275	69.431	-59.427	-.072	39.299	23.364	31.613
980.0	234949.8	21844.2	-.275	69.439	-58.759	-.072	39.142	23.322	31.762
982.0	234780.8	21821.3	-.274	69.447	-58.064	-.062	39.077	23.280	31.912
984.0	234612.7	21798.1	-.273	69.456	-57.618	-.056	39.138	23.238	32.060
986.0	234445.7	21774.9	-.272	69.464	-57.226	-.069	39.143	23.196	32.208
988.0	234279.9	21751.7	-.271	69.473	-56.792	-.060	39.099	23.154	32.355
990.0	234115.4	21728.7	-.269	69.482	-56.499	-.007	39.098	23.113	32.501
992.0	233952.2	21705.7	-.268	69.492	-56.633	.068	39.227	23.072	32.646
994.0	233789.9	21682.3	-.267	69.500	-57.114	-.008	39.402	23.031	32.790
996.0	233628.4	21658.6	-.266	69.508	-57.548	-.028	39.537	22.989	32.932
998.0	233467.4	21634.6	-.266	69.515	-57.960	-.024	39.543	22.948	33.074
1000.0	233306.5	21610.7	-.267	69.522	-58.399	-.041	39.514	22.907	33.216
1002.0	233145.0	21586.8	-.268	69.528	-58.812	-.048	39.507	22.866	33.360
1004.0	232982.6	21562.6	-.270	69.534	-59.252	-.067	39.533	22.824	33.504
1006.0	232819.2	21538.1	-.272	69.538	-59.712	-.091	39.576	22.782	33.648
1008.0	232654.4	21513.3	-.274	69.542	-59.828	-.102	39.594	22.739	33.791
1010.0	232488.1	21488.4	-.276	69.546	-59.790	-.054	39.550	22.696	33.936
1012.0	232320.1	21463.6	-.279	69.550	-59.892	-.115	39.532	22.653	34.084
1014.0	232150.3	21438.8	-.282	69.553	-59.885	-.108	39.551	22.610	34.236
1016.0	231978.3	21413.8	-.285	69.557	-59.844	-.104	39.585	22.566	34.390
1018.0	231804.3	21388.6	-.288	69.559	-59.792	-.120	39.580	22.523	34.548

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1020.0	231628.3	21363.2	-.291	69.562	-59.681	-.142	39.533	22.479	34.708
1022.0	231450.3	21337.8	-.294	69.564	-59.503	-.186	39.525	22.435	34.871
1024.0	231270.4	21312.1	-.297	69.566	-59.175	-.213	39.570	22.390	35.038
1026.0	231088.8	21286.3	-.299	69.567	-58.653	-.218	39.586	22.346	35.207
1028.0	230906.0	21260.3	-.301	69.569	-57.927	-.198	39.563	22.301	35.377
1030.0	230722.4	21234.4	-.302	69.571	-57.226	-.156	39.549	22.256	35.551
1032.0	230538.4	21208.3	-.303	69.574	-56.691	-.192	39.580	22.212	35.725
1034.0	230354.3	21182.1	-.303	69.576	-56.226	-.173	39.587	22.166	35.913
1036.0	230170.5	21155.7	-.303	69.578	-55.887	-.147	39.532	22.122	36.087
1038.0	229986.8	21129.7	-.303	69.581	-55.480	-.135	40.385	22.078	36.263
1040.0	229804.7	21101.2	-.300	69.581	-55.024	-.144	40.128	22.032	36.416
1042.0	229624.1	21074.9	-.299	69.583	-54.477	-.180	39.200	21.990	36.594
1044.0	229444.6	21048.5	-.298	69.588	-53.929	-.110	39.844	21.954	36.784
1046.0	229267.3	21020.2	-.294	69.590	-53.470	-.139	39.701	21.918	36.971
1048.0	229092.5	20993.1	-.291	69.593	-52.680	.027	39.153	21.883	37.158
1050.0	228920.3	20966.5	-.288	69.598	-52.584	-.608	38.848	21.849	37.344
1052.0	228750.9	20940.0	-.285	69.603	-52.278	-.199	38.924	21.815	37.526
1054.0	228584.0	20913.1	-.281	69.607	-52.204	-.086	39.123	21.781	37.704
1056.0	228420.0	20885.9	-.278	69.610	-53.400	-.036	39.289	21.747	37.876
1058.0	228257.8	20858.3	-.277	69.611	-54.763	-.107	39.395	21.713	38.045
1060.0	228096.1	20830.7	-.277	69.611	-56.009	-.175	39.374	21.678	38.213
1062.0	227933.7	20803.1	-.279	69.610	-57.010	-.181	39.403	21.643	38.383
1064.0	227769.7	20775.3	-.283	69.608	-57.798	-.201	39.579	21.608	38.554
1066.0	227603.2	20747.0	-.286	69.605	-58.123	-.201	39.768	21.572	38.728
1068.0	227434.2	20718.4	-.291	69.601	-58.214	-.205	39.752	21.536	38.907
1070.0	227262.4	20689.9	-.295	69.597	-58.043	-.166	39.728	21.500	39.091
1072.0	227087.8	20661.2	-.299	69.593	-57.737	-.171	39.758	21.464	39.281
1074.0	226910.8	20632.3	-.303	69.588	-57.244	-.169	39.785	21.427	39.474
1076.0	226731.6	20603.4	-.306	69.584	-56.869	-.137	39.764	21.391	39.672
1078.0	226550.4	20574.5	-.309	69.580	-56.530	-.142	39.741	21.354	39.875

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1080.0	226367.5	20545.2	-.312	69.576	-56.408	-.097	39.771	21.316	40.086
1082.0	226182.9	20515.6	-.314	69.572	-56.211	-.059	39.739	21.275	40.264
1084.0	225996.7	20486.1	-.317	69.570	-55.984	-.037	39.732	21.231	40.438
1086.0	225808.9	20456.3	-.319	69.566	-56.036	-.025	39.775	21.188	40.615
1088.0	225619.7	20425.9	-.322	69.564	-56.001	.014	39.759	21.143	40.816
1090.0	225428.8	20396.0	-.325	69.560	-55.965	.024	39.737	21.099	41.007
1092.0	225236.1	20365.9	-.328	69.555	-55.901	.032	39.811	21.054	41.201
1094.0	225041.7	20335.6	-.331	69.551	-56.091	.106	39.923	21.010	41.399
1096.0	224845.3	20305.3	-.335	69.546	-56.401	.169	39.879	20.966	41.600
1098.0	224646.4	20274.9	-.339	69.540	-56.818	.214	39.936	20.921	41.807
1100.0	224444.4	20244.2	-.344	69.534	-57.445	.189	40.074	20.876	42.018
1102.0	224238.8	20213.0	-.350	69.526	-58.044	.128	40.162	20.831	42.235
1104.0	224029.3	20181.6	-.357	69.517	-58.504	.083	40.131	20.785	42.459
1106.0	223815.1	20150.1	-.364	69.507	-58.565	.076	40.139	20.739	42.692
1108.0	223596.4	20118.3	-.371	69.496	-58.578	.082	40.180	20.692	42.932
1110.0	223373.0	20086.4	-.378	69.485	-58.459	.055	40.179	20.645	43.195
1112.0	223144.9	20054.4	-.386	69.475	-58.324	.019	40.160	20.598	43.437
1114.0	222912.0	20022.0	-.393	69.467	-57.913	-.015	40.184	20.546	43.685
1116.0	222674.5	19989.8	-.400	69.456	-57.298	.028	40.229	20.493	43.928
1118.0	222433.3	19957.2	-.406	69.446	-56.647	.066	40.282	20.438	44.177
1120.0	222188.8	19924.5	-.410	69.435	-56.060	.124	40.280	20.384	44.433
1122.0	221941.7	19891.8	-.415	69.425	-55.711	.122	40.271	20.330	44.695
1124.0	221692.1	19858.9	-.419	69.415	-55.354	.145	40.294	20.275	44.962
1126.0	221440.2	19825.7	-.422	69.404	-55.045	.195	40.337	20.221	45.233
1128.0	221186.5	19792.4	-.426	69.393	-54.813	.260	40.372	20.166	45.509
1130.0	220931.0	19759.1	-.429	69.382	-54.745	.328	40.335	20.112	45.790
1132.0	220673.7	19725.5	-.432	69.370	-54.961	.377	40.394	20.057	46.075
1134.0	220414.5	19691.5	-.436	69.357	-55.532	.371	40.438	20.002	46.363
1136.0	220153.0	19657.2	-.441	69.343	-56.064	.291	40.417	19.946	46.657
1138.0	219888.6	19622.5	-.446	69.326	-56.443	.222	40.394	19.891	46.955

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1140.0	219621.1	19587.9	-.451	69.309	-56.570	.166	40.414	19.839	47.274
1142.0	219350.5	19553.0	-.457	69.290	-56.456	.165	40.415	19.786	47.590
1144.0	219076.8	19518.1	-.462	69.271	-56.095	.135	40.338	19.733	47.913
1146.0	218800.4	19483.1	-.467	69.251	-55.692	.148	40.333	19.679	48.242
1148.0	218521.6	19447.7	-.470	69.231	-55.382	.170	40.359	19.626	48.576
1150.0	218241.3	19411.6	-.473	69.210	-55.188	.169	40.365	19.571	48.911
1152.0	217960.2	19375.1	-.475	69.187	-54.651	.167	40.219	19.516	49.263
1154.0	217678.7	19338.8	-.475	69.165	-53.725	.176	40.029	19.462	49.600
1156.0	217397.7	19302.8	-.475	69.144	-52.981	.213	39.912	19.408	49.941
1158.0	217117.7	19266.7	-.474	69.123	-52.477	.257	39.866	19.354	50.285
1160.0	216839.3	19230.4	-.472	69.102	-52.559	.344	39.901	19.300	50.627
1162.0	216562.5	19193.6	-.471	69.079	-53.073	.303	39.895	19.246	50.967
1164.0	216286.9	19157.7	-.471	69.054	-53.531	.268	39.859	19.196	51.321
1166.0	216011.9	19121.1	-.471	69.028	-53.900	.221	39.870	19.148	51.676
1168.0	215737.0	19084.1	-.472	68.999	-54.140	.238	39.889	19.099	52.030
1170.0	215462.4	19046.9	-.473	68.970	-54.396	.242	39.901	19.050	52.384
1172.0	215187.5	19009.5	-.474	68.940	-54.697	.230	39.876	19.002	52.738
1174.0	214911.8	18972.2	-.477	68.909	-55.090	.139	39.849	18.953	53.094
1176.0	214634.6	18934.6	-.481	68.877	-55.365	.110	39.872	18.904	53.453
1178.0	214355.6	18896.7	-.484	68.843	-55.544	.094	39.881	18.855	53.814
1180.0	214074.2	18858.4	-.490	68.807	-54.221	-.321	39.900	18.806	54.178
1182.0	213792.8	18819.6	-.486	68.776	-51.159	.181	39.905	18.756	54.545
1184.0	213516.0	18780.2	-.478	68.746	-48.775	1.822	39.769	18.705	54.912
1186.0	213245.9	18740.7	-.469	68.716	-49.867	1.073	39.838	18.654	55.276
1188.0	212981.4	18701.7	-.463	68.684	-50.726	.508	40.191	18.605	55.634
1190.0	212721.7	18659.1	-.455	68.647	-51.247	.268	40.746	18.552	55.927
1192.0	212467.3	18617.6	-.449	68.609	-51.714	.133	40.014	18.501	56.235
1194.0	212216.5	18577.3	-.446	68.571	-52.120	.105	39.769	18.451	56.542
1196.0	211968.1	18537.2	-.444	68.533	-53.110	.120	39.672	18.402	56.847
1198.0	211720.8	18497.1	-.445	68.492	-54.280	.120	39.623	18.352	57.150

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1200.0	211472.8	18456.8	-.448	68.448	-55.522	.119	39.668	18.302	57.454
1202.0	211222.7	18415.8	-.453	68.401	-56.748	.088	39.738	18.252	57.760
1204.0	210969.3	18374.4	-.461	68.351	-57.773	-.003	39.810	18.201	58.072
1206.0	210711.0	18332.8	-.470	68.299	-58.213	.018	39.818	18.150	58.394
1208.0	210447.3	18291.1	-.480	68.247	-58.490	.018	39.838	18.098	58.743
1210.0	210177.6	18249.0	-.491	68.193	-58.600	.023	39.908	18.046	59.070
1212.0	209901.8	18207.2	-.501	68.138	-58.485	.085	39.988	17.995	59.447
1214.0	209620.2	18165.5	-.512	68.079	-58.324	.113	40.055	17.946	59.837
1216.0	209332.8	18123.6	-.522	68.021	-58.106	.152	40.105	17.897	60.242
1218.0	209039.9	18081.3	-.532	67.961	-58.170	.206	40.179	17.848	60.659
1220.0	208741.7	18038.4	-.542	67.900	-58.400	.213	40.251	17.798	61.087
1222.0	208438.0	17995.2	-.552	67.836	-58.696	.208	40.255	17.747	61.529
1224.0	208128.2	17951.8	-.564	67.772	-59.080	.145	40.256	17.696	61.986
1226.0	207811.9	17908.1	-.576	67.705	-59.325	.143	40.263	17.645	62.460
1228.0	207488.6	17864.0	-.589	67.637	-59.501	.129	40.321	17.594	62.952
1230.0	207158.2	17819.5	-.602	67.567	-59.577	.151	40.305	17.541	63.462
1232.0	206820.5	17774.9	-.615	67.496	-59.642	.133	40.322	17.489	63.993
1234.0	206475.5	17729.8	-.629	67.423	-59.598	.151	40.378	17.436	64.543
1236.0	206123.4	17684.2	-.642	67.349	-59.553	.136	40.415	17.382	65.110
1238.0	205764.4	17638.1	-.654	67.273	-59.471	.099	40.416	17.327	65.697
1240.0	205398.8	17591.6	-.667	67.195	-59.329	.043	40.390	17.272	66.302
1242.0	205026.8	17544.8	-.679	67.116	-59.035	-.016	40.375	17.217	66.938
1244.0	204648.9	17497.7	-.690	67.036	-58.428	-.024	40.359	17.161	67.561
1246.0	204266.1	17450.3	-.699	66.955	-57.694	.003	40.338	17.106	68.201
1248.0	203879.3	17403.3	-.706	66.875	-57.052	.079	40.341	17.050	68.905
1250.0	203489.9	17354.6	-.712	66.792	-56.658	.074	40.364	16.993	69.587
1252.0	203098.9	17304.5	-.716	66.708	-56.305	.086	40.396	16.934	70.247
1254.0	202706.7	17254.1	-.720	66.623	-55.923	.083	40.360	16.874	70.907
1256.0	202314.0	17203.5	-.722	66.539	-55.551	.115	40.343	16.815	71.569
1258.0	201921.2	17152.6	-.724	66.453	-55.515	.204	40.336	16.755	72.235

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1260.0	201528.5	17101.3	-.727	66.365	-55.769	.216	40.380	16.694	72.899
1262.0	201135.6	17049.6	-.729	66.276	-56.253	.213	40.420	16.633	73.565
1264.0	200741.9	16997.4	-.734	66.183	-56.967	.146	40.414	16.572	74.233
1266.0	200346.2	16944.6	-.740	66.086	-57.550	.124	40.419	16.510	74.905
1268.0	199948.6	16890.3	-.746	65.984	-58.060	.029	40.439	16.447	75.572
1270.0	199549.0	16835.3	-.752	65.878	-57.561	-.105	40.339	16.382	76.242
1272.0	199148.4	16780.1	-.754	65.772	-56.156	-.092	40.135	16.318	76.917
1274.0	198749.8	16724.5	-.750	65.666	-54.646	-.008	39.982	16.253	77.587
1276.0	198355.9	16668.9	-.743	65.562	-53.328	.029	39.800	16.189	78.244
1278.0	197969.0	16613.2	-.732	65.458	-52.927	.049	39.672	16.124	78.882
1280.0	197590.3	16556.7	-.720	65.351	-52.780	.080	39.537	16.059	79.491
1282.0	197220.8	16499.5	-.705	65.241	-52.887	.079	39.387	15.993	80.067
1284.0	196861.0	16441.6	-.691	65.125	-53.133	-.092	39.238	15.927	80.598
1286.0	196511.3	16384.4	-.676	65.011	-52.459	-.122	38.979	15.858	81.062
1288.0	196172.0	16328.1	-.659	64.899	-51.649	-.093	38.744	15.791	81.502
1290.0	195843.8	16272.1	-.642	64.788	-51.648	.001	38.671	15.727	81.967
1292.0	195526.4	16215.8	-.626	64.674	-52.659	-.017	38.652	15.660	82.313
1294.0	195218.2	16159.2	-.614	64.556	-53.843	-.036	38.676	15.594	82.654
1296.0	194916.4	16102.1	-.608	64.430	-53.723	-.699	38.724	15.528	82.968
1298.0	194621.6	16044.1	-.588	64.313	-45.854	-.358	38.872	15.461	83.252
1300.0	194347.4	15985.6	-.539	64.221	-36.222	-.152	38.893	15.394	83.463
1302.0	194108.4	15926.9	-.467	64.160	-26.651	-.204	38.897	15.328	83.561
1304.0	193915.4	15868.1	-.378	64.133	-16.825	-.224	38.925	15.265	83.564
1306.0	193775.8	15809.1	-.277	64.145	-6.702	-.197	38.974	15.202	83.316
1308.0	193693.6	15750.1	-.173	64.198	3.588	-.205	39.035	15.143	82.954
1310.0	193668.3	15691.0	-.072	64.293	13.969	-.171	39.132	15.085	82.394
1312.0	193695.1	15632.1	.017	64.429	24.255	-.178	39.269	15.029	81.694
1314.0	193764.8	15573.6	.085	64.602	34.532	-.179	39.446	14.975	80.869
1316.0	193864.3	15515.2	.128	64.808	44.830	-.165	39.721	14.921	79.963
1318.0	193978.0	15456.8	.139	65.042	55.104	-.121	40.013	14.868	79.021

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1320.0	194087.5	15398.5	.115	65.299	65.358	-.063	40.380	14.815	78.102
1322.0	194173.2	15339.7	.052	65.572	75.459	-.034	40.886	14.761	77.256
1324.0	194214.1	15280.0	-.051	65.857	85.065	.198	41.432	14.704	76.537
1326.0	194189.0	15219.6	-.188	66.145	89.326	.570	41.899	14.645	76.006
1328.0	194089.0	15158.0	-.330	66.437	89.346	.409	42.388	14.583	75.677
1330.0	193914.4	15095.1	-.470	66.731	88.121	.333	42.773	14.518	75.548
1332.0	193667.7	15031.2	-.604	67.028	85.469	.336	43.106	14.450	75.612
1334.0	193354.8	14966.3	-.725	67.328	81.111	.308	43.320	14.376	75.763
1336.0	192985.1	14901.3	-.824	67.627	74.989	.274	43.320	14.293	75.973
1338.0	192572.0	14836.7	-.895	67.920	67.686	.177	43.241	14.217	76.424
1340.0	192131.5	14771.5	-.938	68.207	61.540	.279	43.074	14.139	76.945
1342.0	191676.2	14706.8	-.957	68.482	54.833	.184	42.969	14.062	77.511
1344.0	191219.1	14642.1	-.953	68.741	49.978	.006	42.840	13.984	78.084
1346.0	190769.3	14577.0	-.938	68.996	48.358	.052	42.710	13.907	78.631
1348.0	190329.5	14511.5	-.919	69.250	47.089	.130	42.583	13.830	79.145
1350.0	189903.1	14445.8	-.893	69.499	47.366	-.092	42.409	13.753	79.614
1352.0	189488.7	14380.7	-.877	69.757	48.869	.174	42.145	13.679	80.052
1354.0	189082.6	14315.7	-.867	70.020	49.861	.974	41.962	13.604	80.469
1356.0	188683.0	14250.7	-.855	70.284	49.056	.426	41.890	13.530	80.864
1358.0	188291.8	14185.5	-.840	70.546	48.486	.170	42.407	13.457	81.231
1360.0	187911.1	14117.7	-.819	70.813	48.078	.114	42.024	13.381	81.534
1362.0	187541.5	14052.1	-.800	71.076	47.704	.100	41.622	13.307	81.829
1364.0	187182.6	13986.8	-.780	71.340	47.256	.159	41.384	13.235	82.093
1366.0	186835.3	13921.9	-.758	71.597	46.332	.045	41.183	13.164	82.338
1368.0	186500.7	13857.1	-.734	71.850	46.392	-.028	41.034	13.096	82.560
1370.0	186178.2	13792.6	-.712	72.105	47.014	-.026	40.881	13.029	82.746
1372.0	185866.4	13728.5	-.695	72.363	47.860	-.076	40.773	12.962	82.901
1374.0	185563.0	13664.6	-.682	72.626	49.029	-.098	40.727	12.896	83.029
1376.0	185265.8	13600.5	-.673	72.894	50.373	-.114	40.677	12.829	83.132
1378.0	184972.0	13536.6	-.672	73.167	51.691	-.077	40.657	12.763	83.224

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1380.0	184678.4	13472.9	-.676	73.445	52.865	-.020	40.654	12.697	83.314
1382.0	184382.7	13408.7	-.684	73.729	53.685	-.013	40.657	12.631	83.399
1384.0	184083.5	13344.4	-.696	74.016	54.167	.015	40.644	12.564	83.490
1386.0	183779.6	13280.0	-.709	74.305	54.093	.085	40.582	12.498	83.590
1388.0	183470.8	13215.9	-.721	74.598	53.529	.091	40.537	12.435	83.751
1390.0	183157.7	13151.8	-.732	74.890	52.945	-.007	40.525	12.374	83.937
1392.0	182841.2	13087.8	-.741	75.182	52.544	.011	40.524	12.313	84.135
1394.0	182521.7	13023.8	-.750	75.474	52.204	.013	40.529	12.251	84.338
1396.0	182199.8	12959.5	-.757	75.767	51.753	-.030	40.527	12.190	84.544
1398.0	181876.2	12895.2	-.763	76.059	51.355	-.085	40.656	12.129	84.751
1400.0	181551.7	12830.1	-.766	76.352	50.928	-.152	40.698	12.067	84.949
1402.0	181227.1	12765.0	-.769	76.646	50.644	-.139	40.639	12.005	85.144
1404.0	180902.9	12700.1	-.771	76.939	50.248	-.102	40.558	11.944	85.337
1406.0	180579.1	12635.6	-.772	77.231	49.760	-.102	40.477	11.882	85.529
1408.0	180256.4	12571.2	-.772	77.522	49.334	-.170	40.458	11.822	85.718
1410.0	179935.0	12506.9	-.772	77.814	49.198	-.189	40.376	11.761	85.898
1412.0	179615.2	12442.5	-.771	78.107	49.265	-.168	40.355	11.700	86.079
1414.0	179296.7	12378.0	-.771	78.402	49.402	-.155	40.309	11.640	86.257
1416.0	178978.7	12314.1	-.774	78.696	49.523	-.183	40.264	11.580	86.436
1418.0	178660.2	12250.4	-.780	78.992	49.742	-.180	40.276	11.520	86.617
1420.0	178340.3	12186.7	-.787	79.289	50.056	-.134	40.310	11.461	86.798
1422.0	178018.3	12122.8	-.796	79.590	50.314	-.183	40.354	11.401	86.981
1424.0	177693.1	12059.0	-.808	79.892	50.820	-.145	40.394	11.341	87.169
1426.0	177363.7	11995.0	-.823	80.198	51.303	-.076	40.440	11.281	87.367
1428.0	177028.8	11930.7	-.840	80.506	51.603	-.041	40.474	11.222	87.589
1430.0	176688.1	11865.3	-.858	80.817	51.759	-.035	40.502	11.165	87.866
1432.0	176341.5	11799.6	-.875	81.131	51.373	-.002	40.494	11.108	88.154
1434.0	175989.8	11733.6	-.889	81.444	50.346	.036	40.460	11.050	88.452
1436.0	175635.1	11667.8	-.898	81.754	48.930	.054	40.366	10.993	88.758
1438.0	175279.6	11602.3	-.901	82.058	47.811	-.040	40.299	10.935	89.068

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1440.0	174925.3	11536.9	-.901	82.361	47.287	-.104	40.246	10.878	89.368
1442.0	174572.7	11471.5	-.900	82.662	46.941	-.176	40.210	10.821	89.660
1444.0	174222.4	11406.0	-.898	82.966	47.110	-.187	40.160	10.763	89.933
1446.0	173874.2	11340.5	-.899	83.273	47.532	-.155	40.099	10.706	90.195
1448.0	173526.7	11274.9	-.903	83.587	48.021	-.114	40.074	10.648	90.457
1450.0	173178.6	11209.2	-.909	83.908	48.584	-.051	40.019	10.590	90.716
1452.0	172829.1	11143.2	-.919	84.234	49.247	.047	39.964	10.532	90.972
1454.0	172476.7	11077.3	-.932	84.564	49.533	.059	39.926	10.474	91.235
1456.0	172120.4	11011.8	-.948	84.895	49.742	.101	39.857	10.416	91.512
1458.0	171759.6	10946.3	-.965	85.230	49.817	.098	39.812	10.359	91.831
1460.0	171393.9	10880.7	-.982	85.566	49.650	.012	39.791	10.301	92.118
1462.0	171023.8	10815.0	-.998	85.903	49.450	-.074	39.754	10.243	92.414
1464.0	170649.9	10749.0	-1.012	86.242	49.224	-.139	39.692	10.185	92.716
1466.0	170272.8	10682.7	-1.025	86.585	49.040	-.196	39.641	10.122	92.927
1468.0	169893.4	10616.1	-1.036	86.932	49.151	-.188	39.562	10.054	93.056
1470.0	169511.1	10549.3	-1.051	87.285	49.461	-.059	39.466	9.985	93.227
1472.0	169125.1	10483.1	-1.067	87.638	49.460	-.048	39.321	9.918	93.383
1474.0	168735.1	10417.4	-1.084	87.993	49.519	-.021	39.221	9.851	93.552
1476.0	168340.7	10351.8	-1.102	88.350	49.443	-.083	39.165	9.784	93.732
1478.0	167942.3	10285.7	-1.119	88.712	49.561	-.065	39.111	9.716	93.911
1480.0	167539.6	10219.4	-1.134	89.075	46.760	.084	39.102	9.649	94.092
1482.0	167138.3	10153.1	-1.124	89.415	42.379	-.154	38.980	9.581	94.252
1484.0	166746.1	10087.2	-1.097	89.738	39.823	-.210	38.810	9.514	94.374
1486.0	166366.7	10021.7	-1.064	90.053	38.726	-.179	38.690	9.447	94.451
1488.0	166001.3	9956.7	-1.029	90.365	38.213	-.189	38.555	9.381	94.482
1490.0	165649.8	9892.2	-.996	90.675	38.338	-.190	38.425	9.316	94.466
1492.0	165311.2	9828.3	-.966	90.988	39.044	-.205	38.328	9.252	94.408
1494.0	164983.6	9764.6	-.943	91.308	40.335	-.193	38.284	9.188	94.308
1496.0	164664.3	9701.2	-.928	91.638	41.664	-.109	38.234	9.124	94.178
1498.0	164350.6	9637.9	-.919	91.975	42.605	-.118	38.170	9.061	94.023

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1500.0	164040.7	9575.0	-.916	92.318	43.179	-.132	38.087	8.998	93.854
1502.0	163732.7	9514.2	-.917	92.663	43.573	-.141	37.973	8.937	93.704
1504.0	163425.4	9453.9	-.922	93.010	44.036	-.192	37.878	8.877	93.554
1506.0	163117.3	9393.7	-.931	93.361	44.713	-.194	37.849	8.817	93.402
1508.0	162806.9	9333.7	-.945	93.718	45.226	-.170	37.800	8.757	93.256
1510.0	162492.9	9274.2	-.965	94.077	45.715	-.105	37.728	8.697	93.123
1512.0	162173.4	9215.2	-.989	94.438	45.960	-.145	37.664	8.638	93.012
1514.0	161847.7	9156.2	-1.014	94.805	46.444	-.093	37.608	8.579	92.913
1516.0	161515.0	9097.2	-1.042	95.175	46.344	-.077	37.553	8.520	92.831
1518.0	161175.3	9038.5	-1.070	95.544	45.750	-.058	37.436	8.461	92.770
1520.0	160829.3	8980.2	-1.094	95.910	44.945	-.091	37.296	8.403	92.734
1522.0	160477.7	8922.6	-1.117	96.269	44.272	-.034	37.170	8.348	92.772
1524.0	160121.2	8865.4	-1.139	96.624	43.598	-.049	37.056	8.293	92.843
1526.0	159760.0	8808.7	-1.160	96.977	43.343	-.041	36.959	8.240	92.930
1528.0	159394.3	8752.3	-1.182	97.330	43.287	-.028	36.881	8.186	93.035
1530.0	159023.6	8696.3	-1.206	97.685	43.442	-.001	36.838	8.133	93.157
1532.0	158647.1	8640.5	-1.234	98.042	43.789	.061	36.761	8.080	93.298
1534.0	158263.7	8585.1	-1.266	98.402	44.184	.114	36.705	8.028	93.464
1536.0	157871.9	8530.1	-1.305	98.770	43.147	.783	36.660	7.975	93.661
1538.0	157473.4	8474.8	-1.316	99.109	34.601	.358	36.799	7.923	93.867
1540.0	157081.1	8418.6	-1.281	99.382	25.127	.281	36.738	7.870	94.036
1542.0	156706.3	8362.6	-1.214	99.584	15.291	.291	36.558	7.818	94.140
1544.0	156356.6	8307.0	-1.127	99.707	4.907	.235	36.408	7.765	94.152
1546.0	156035.5	8252.0	-1.035	99.744	-5.398	.266	36.225	7.714	94.065
1548.0	155741.4	8197.6	-.955	99.696	-15.937	.238	36.068	7.663	93.885
1550.0	155468.8	8143.6	-.902	99.564	-26.488	.208	35.917	7.612	93.631
1552.0	155207.8	8089.9	-.889	99.353	-36.980	.212	35.789	7.562	93.335
1554.0	154945.3	8036.6	-.930	99.069	-46.422	-.075	35.715	7.512	93.043
1556.0	154666.3	7983.9	-1.013	98.747	-49.843	-.107	35.487	7.463	92.819
1558.0	154364.4	7931.8	-1.109	98.415	-51.302	-.007	35.398	7.414	92.686

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1560.0	154036.9	7879.9	-1.214	98.079	-52.197	.055	35.353	7.365	92.637
1562.0	153682.0	7828.0	-1.326	97.745	-52.737	.013	35.307	7.316	92.679
1564.0	153298.6	7776.4	-1.442	97.408	-52.609	-.007	35.271	7.268	92.822
1566.0	152886.5	7724.9	-1.558	97.070	-51.992	-.083	35.227	7.220	93.064
1568.0	152447.5	7673.3	-1.666	96.733	-50.742	-.107	35.164	7.171	93.391
1570.0	151984.3	7621.5	-1.760	96.401	-47.795	-.146	35.125	7.123	93.792
1572.0	151502.5	7569.9	-1.832	96.089	-44.028	-.104	34.994	7.074	94.260
1574.0	151008.0	7518.8	-1.882	95.803	-40.300	.021	34.792	7.026	94.779
1576.0	150506.6	7468.8	-1.915	95.531	-38.173	.088	34.668	6.982	95.434
1578.0	150001.7	7419.2	-1.937	95.267	-36.865	.129	34.538	6.939	96.131
1580.0	149495.5	7369.6	-1.953	95.008	-35.711	.139	34.336	6.897	96.832
1582.0	148989.5	7320.4	-1.964	94.756	-34.621	.133	34.132	6.854	97.540
1584.0	148484.7	7271.8	-1.971	94.511	-33.735	.242	33.932	6.812	98.255
1586.0	147982.0	7223.4	-1.977	94.270	-33.819	.335	33.766	6.770	98.964
1588.0	147480.5	7175.6	-1.990	94.014	-34.931	.275	33.606	6.729	99.696
1590.0	146978.7	7128.2	-2.009	93.726	-36.384	.214	33.440	6.690	100.491
1592.0	146474.6	7081.0	-2.036	93.424	-37.549	.105	33.299	6.650	101.298
1594.0	145966.5	7034.1	-2.069	93.113	-37.846	.120	33.122	6.611	102.129
1596.0	145453.9	6987.6	-2.103	92.801	-37.852	.127	32.924	6.572	102.988
1598.0	144936.7	6941.2	-2.136	92.484	-37.912	.106	32.740	6.533	103.869
1600.0	144415.7	6894.0	-2.164	92.158	-38.644	.087	32.641	6.494	104.741
1602.0	143891.6	6846.3	-2.195	91.812	-38.723	-.149	32.467	6.454	105.608
1604.0	143364.8	6799.1	-2.215	91.478	-35.300	-.268	32.131	6.414	106.502
1606.0	142840.0	6752.7	-2.214	91.178	-32.764	-.016	31.849	6.375	107.407
1608.0	142320.0	6706.7	-2.207	90.885	-32.640	.118	31.580	6.337	108.300
1610.0	141805.1	6660.6	-2.202	90.581	-33.607	.156	31.392	6.298	109.165
1612.0	141294.4	6614.8	-2.205	90.266	-34.779	.121	31.160	6.259	110.020
1614.0	140785.9	6568.9	-2.215	89.933	-35.930	.071	30.906	6.221	110.878
1616.0	140278.1	6522.7	-2.231	89.580	-36.793	.026	30.674	6.182	111.744
1618.0	139770.0	6476.8	-2.252	89.217	-37.753	-.029	30.467	6.143	112.617

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1620.0	139259.9	6431.5	-2.283	88.846	-38.250	-.057	30.218	6.106	113.518
1622.0	138746.0	6387.0	-2.318	88.474	-38.241	.006	30.021	6.068	114.461
1624.0	138228.1	6342.5	-2.354	88.096	-38.722	.041	29.955	6.031	115.421
1626.0	137706.0	6297.7	-2.392	87.707	-39.373	-.009	29.813	5.993	116.374
1628.0	137179.2	6251.0	-2.432	87.326	-39.523	-.046	29.652	5.946	116.996
1630.0	136648.3	6204.0	-2.467	86.936	-39.347	-.091	29.487	5.899	117.613
1632.0	136114.5	6157.1	-2.500	86.545	-38.876	-.144	29.277	5.851	118.242
1634.0	135578.1	6111.0	-2.531	86.161	-37.783	-.147	29.026	5.805	118.899
1636.0	135039.7	6065.5	-2.559	85.788	-37.088	-.023	28.858	5.759	119.583
1638.0	134499.9	6020.2	-2.587	85.412	-37.606	.026	28.729	5.714	120.269
1640.0	133958.0	5972.2	-2.620	85.034	-38.479	.012	28.614	5.673	121.166
1642.0	133413.6	5923.8	-2.655	84.646	-38.815	.005	28.464	5.632	122.083
1644.0	132866.7	5875.3	-2.689	84.251	-38.614	.006	28.290	5.592	123.004
1646.0	132318.2	5826.8	-2.717	83.854	-38.006	.070	28.108	5.551	123.924
1648.0	131769.4	5778.6	-2.740	83.460	-37.196	.146	27.888	5.510	124.844
1650.0	131220.6	5731.2	-2.764	83.074	-36.719	.229	27.629	5.471	125.788
1652.0	130671.7	5685.6	-2.789	82.702	-37.064	.358	27.499	5.433	126.864
1654.0	130121.9	5640.3	-2.822	82.317	-38.464	.368	27.451	5.395	127.954
1656.0	129569.4	5594.8	-2.863	81.912	-39.554	.264	27.363	5.358	129.046
1658.0	129013.4	5549.1	-2.907	81.493	-39.978	.271	27.204	5.320	130.143
1660.0	128453.6	5503.5	-2.952	81.064	-40.273	.243	27.031	5.282	131.255
1662.0	127889.9	5458.0	-2.998	80.628	-40.163	.214	26.846	5.244	132.388
1664.0	127322.8	5415.2	-3.039	80.177	-39.954	.195	26.637	5.215	134.056
1666.0	126752.7	5372.7	-3.079	79.720	-39.904	.180	26.448	5.187	135.766
1668.0	126180.1	5330.2	-3.118	79.256	-39.949	.123	26.251	5.158	137.505
1670.0	125605.2	5287.8	-3.153	78.786	-39.728	.076	26.035	5.129	139.262
1672.0	125029.4	5245.2	-3.183	78.309	-39.625	.028	25.839	5.100	141.025
1674.0	124453.6	5203.2	-3.207	77.828	-39.113	-.051	25.550	5.071	142.773
1676.0	123878.6	5163.3	-3.227	77.346	-38.366	-.108	25.253	5.039	144.470
1678.0	123304.9	5123.8	-3.244	76.871	-37.857	-.108	25.048	5.007	146.191

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1680.0	122733.1	5084.6	-3.260	76.397	-37.608	-.045	24.873	4.976	147.917
1682.0	122163.0	5045.6	-3.275	75.919	-37.954	-.007	24.710	4.945	149.642
1684.0	121595.1	5006.1	-3.290	75.418	-38.977	-.111	24.565	4.913	151.326
1686.0	121028.8	4966.1	-3.311	74.912	-39.518	-.155	24.334	4.879	152.938
1688.0	120463.0	4926.0	-3.341	74.410	-39.734	-.182	24.097	4.845	154.507
1690.0	119896.5	4886.5	-3.373	73.912	-39.318	-.041	23.930	4.810	156.107
1692.0	119329.5	4847.0	-3.404	73.414	-39.356	.054	23.805	4.776	157.715
1694.0	118761.9	4807.8	-3.439	72.910	-39.666	.119	23.684	4.742	159.336
1696.0	118192.7	4768.7	-3.482	72.392	-40.507	.012	23.551	4.708	160.975
1698.0	117621.1	4729.4	-3.524	71.864	-40.318	.033	23.435	4.673	162.618
1700.0	117048.6	4689.9	-3.555	71.331	-40.874	.053	23.318	4.639	164.243
1702.0	116476.1	4649.9	-3.589	70.762	-41.203	-.068	23.156	4.603	165.821
1704.0	115903.7	4608.7	-3.609	70.181	-40.811	-.006	23.596	4.567	167.310
1706.0	115334.6	4568.0	-3.630	69.599	-40.836	.006	22.902	4.531	168.789
1708.0	114765.8	4528.6	-3.667	69.021	-40.658	-.030	22.513	4.496	170.355
1710.0	114196.8	4490.6	-3.696	68.425	-39.917	-.032	22.269	4.461	171.918
1712.0	113628.5	4453.0	-3.722	67.832	-39.585	.006	22.040	4.426	173.493
1714.0	113060.9	4415.7	-3.753	67.230	-40.042	-.079	21.838	4.391	175.067
1716.0	112493.4	4378.4	-3.786	66.627	-39.581	.002	21.667	4.356	176.643
1718.0	111926.4	4341.3	-3.816	66.024	-39.471	.049	21.509	4.321	178.216
1720.0	111359.6	4304.7	-3.848	65.420	-39.264	.122	21.361	4.286	179.768
1722.0	110792.5	4268.4	-3.887	64.797	-40.029	.066	21.203	4.249	181.107
1724.0	110224.6	4231.8	-3.930	64.143	-41.108	-.124	21.033	4.211	182.420
1726.0	109654.9	4195.3	-3.979	63.481	-41.061	-.104	20.924	4.173	183.734
1728.0	109083.8	4158.7	-4.020	62.817	-40.552	-.007	20.788	4.136	185.027
1730.0	108512.6	4122.1	-4.053	62.153	-40.047	.059	20.617	4.098	186.297
1732.0	107941.9	4085.7	-4.088	61.500	-39.256	.188	20.403	4.062	187.675
1734.0	107371.7	4049.3	-4.121	60.852	-38.795	.232	20.234	4.027	189.190
1736.0	106802.9	4012.6	-4.142	60.199	-38.233	.239	20.117	3.992	190.734
1738.0	106237.6	3975.6	-4.152	59.532	-38.653	.134	19.926	3.957	192.106

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1740.0	105676.3	3938.7	-4.167	58.849	-38.961	.050	19.666	3.922	193.425
1742.0	105117.2	3902.4	-4.198	58.168	-39.120	.023	19.336	3.887	194.769
1744.0	104558.3	3866.8	-4.242	57.489	-39.064	.014	19.093	3.853	196.157
1746.0	103998.8	3831.3	-4.285	56.808	-38.675	.032	18.936	3.819	197.532
1748.0	103439.6	3795.7	-4.321	56.118	-38.480	-.154	18.808	3.785	198.867
1750.0	102882.2	3760.0	-4.321	55.468	-31.461	-.285	18.762	3.751	200.130
1752.0	102337.1	3724.0	-4.222	54.975	-21.711	-.142	18.664	3.716	201.229
1754.0	101814.8	3688.0	-4.053	54.668	-11.367	-.051	18.523	3.682	202.080
1756.0	101322.0	3651.5	-3.846	54.559	-1.721	-.122	18.355	3.648	202.716
1758.0	100861.5	3614.4	-3.629	54.659	8.680	-.093	18.328	3.613	203.040
1760.0	100431.1	3577.1	-3.444	54.969	18.368	-.092	18.173	3.578	203.021
1762.0	100024.0	3539.9	-3.333	55.478	28.179	-.027	18.004	3.544	202.743
1764.0	99628.7	3503.0	-3.317	56.156	35.521	.196	17.773	3.509	202.346
1766.0	99234.8	3466.5	-3.365	56.913	38.333	.127	17.618	3.475	201.933
1768.0	98836.6	3430.6	-3.452	57.708	40.267	.069	17.490	3.441	201.572
1770.0	98430.1	3394.9	-3.567	58.533	41.408	.035	17.428	3.408	201.289
1772.0	98012.9	3359.8	-3.700	59.373	42.115	.056	17.388	3.374	201.082
1774.0	97584.0	3324.8	-3.834	60.231	42.062	.010	17.380	3.340	200.928
1776.0	97144.2	3289.7	-3.963	61.100	42.066	-.015	17.377	3.307	200.825
1778.0	96694.0	3254.8	-4.095	61.977	42.054	-.048	17.322	3.273	200.806
1780.0	96233.4	3220.2	-4.226	62.858	41.708	-.122	17.286	3.240	200.860
1782.0	95762.8	3185.7	-4.356	63.739	41.476	-.206	17.237	3.207	200.996
1784.0	95282.8	3151.5	-4.488	64.635	41.862	-.166	17.152	3.174	201.193
1786.0	94793.1	3117.4	-4.621	65.564	42.129	-.112	17.089	3.141	201.409
1788.0	94294.1	3083.7	-4.753	66.521	41.847	-.211	16.992	3.107	201.642
1790.0	93785.7	3050.3	-4.896	67.501	42.927	-.256	16.954	3.074	201.947
1792.0	93266.7	3017.4	-5.054	68.540	45.575	.736	16.786	3.042	202.468
1794.0	92736.5	2984.2	-5.219	69.585	46.737	-.193	16.697	3.009	202.920
1796.0	92190.2	2951.5	-5.466	70.712	48.940	.119	16.528	2.976	203.536
1798.0	91623.7	2918.9	-5.725	71.845	48.648	.088	16.319	2.946	204.640

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1800.0	91038.0	2886.5	-5.941	72.939	43.264	-.127	16.216	2.917	206.101
1802.0	90441.4	2854.3	-6.082	73.973	41.250	-.026	16.119	2.888	207.658
1804.0	89839.4	2821.7	-6.180	74.997	39.308	.105	16.026	2.859	209.202
1806.0	89236.4	2789.3	-6.239	75.984	36.966	.038	15.855	2.830	210.728
1808.0	88635.6	2756.9	-6.279	76.953	36.539	.077	15.677	2.801	212.211
1810.0	88037.7	2724.9	-6.318	77.919	35.817	.091	15.504	2.772	213.665
1812.0	87443.4	2692.9	-6.343	78.873	34.896	.028	15.327	2.743	215.030
1814.0	86854.0	2660.9	-6.362	79.838	35.205	.075	15.136	2.714	216.289
1816.0	86269.3	2629.0	-6.387	80.822	34.889	.188	14.921	2.685	217.467
1818.0	85689.4	2597.3	-6.408	81.797	34.757	.192	14.743	2.656	218.571
1820.0	85113.8	2565.7	-6.439	82.789	34.533	.226	14.531	2.626	219.414
1822.0	84541.9	2534.3	-6.477	83.779	33.854	.173	14.369	2.595	220.088
1824.0	83973.8	2502.9	-6.508	84.779	34.144	.175	14.318	2.564	220.659
1826.0	83409.9	2471.2	-6.533	85.799	33.183	.293	14.335	2.533	221.050
1828.0	82854.4	2438.9	-6.458	86.717	24.481	.340	14.179	2.501	221.174
1830.0	82316.3	2407.2	-6.294	87.348	14.211	.251	13.911	2.469	221.150
1832.0	81801.6	2374.7	-6.069	87.643	3.643	.007	13.802	2.436	220.597
1834.0	81313.6	2341.5	-5.821	87.641	-5.284	-.012	13.761	2.403	219.516
1836.0	80852.6	2307.6	-5.572	87.375	-13.163	.047	13.943	2.368	217.943
1838.0	80418.3	2272.9	-5.326	86.924	-16.299	.262	14.131	2.333	215.848
1840.0	80009.7	2237.6	-5.085	86.385	-18.181	.246	14.240	2.297	213.308
1842.0	79626.5	2202.0	-4.844	85.778	-18.969	.162	14.075	2.261	210.381
1844.0	79266.3	2167.0	-4.647	85.154	-19.111	-.382	13.739	2.225	207.260
1846.0	78925.3	2132.7	-4.486	84.620	-15.650	.530	13.496	2.190	204.040
1848.0	78600.2	2099.1	-4.364	84.118	-16.481	.420	13.517	2.156	200.738
1850.0	78289.2	2065.6	-4.233	83.624	-13.954	1.045	13.522	2.122	197.358
1852.0	77992.1	2032.9	-4.129	83.131	-15.921	.458	13.257	2.089	194.059
1854.0	77704.9	2001.2	-4.088	82.638	-15.542	.173	12.953	2.056	190.810
1856.0	77423.6	1970.3	-4.087	82.205	-13.587	.141	12.631	2.025	187.617
1858.0	77145.0	1940.4	-4.143	81.824	-12.295	.107	12.199	1.995	184.562

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1860.0	76864.2	1911.9	-4.281	81.498	-11.069	.100	11.728	1.966	181.756
1862.0	76576.1	1884.6	-4.488	81.226	-9.727	.171	11.333	1.938	179.202
1864.0	76276.6	1858.3	-4.755	80.991	-9.016	.228	11.006	1.912	176.904
1866.0	75962.3	1832.9	-5.076	80.769	-8.745	.210	10.739	1.886	174.881
1868.0	75631.0	1808.3	-5.422	80.551	-8.446	.144	10.641	1.861	173.108
1870.0	75281.9	1784.4	-5.800	80.365	-7.329	.145	10.371	1.837	171.574
1872.0	74912.6	1761.5	-6.224	80.217	-6.436	.195	10.087	1.814	170.368
1874.0	74521.1	1739.4	-6.672	80.071	-6.504	.189	10.053	1.792	169.451
1876.0	74108.1	1717.6	-7.118	79.907	-6.726	.096	9.907	1.770	168.738
1878.0	73673.2	1696.5	-7.585	79.765	-5.856	.033	9.750	1.749	168.302
1880.0	73216.0	1676.0	-8.058	79.685	-4.319	.126	9.753	1.728	168.109
1882.0	72738.0	1655.6	-8.502	79.656	-3.292	.456	9.725	1.708	168.086
1884.0	72240.8	1635.8	-8.938	79.560	-4.758	.400	9.569	1.688	168.281
1886.0	71725.2	1613.3	-9.387	79.330	-5.477	-.065	9.464	1.667	168.167
1888.0	71192.2	1590.0	-9.829	79.113	-4.422	-.296	9.575	1.645	168.024
1890.0	70644.1	1566.9	-10.230	78.986	-2.537	-.053	9.547	1.623	167.966
1892.0	70082.8	1544.3	-10.628	78.823	-3.421	-.029	9.467	1.602	168.119
1894.0	69508.8	1525.0	-10.994	78.622	-3.673	-.155	9.384	1.585	169.271
1896.0	68923.4	1505.8	-11.349	78.408	-3.687	-.350	9.326	1.569	170.535
1898.0	68327.7	1486.8	-11.675	78.225	-2.697	-.365	9.401	1.553	171.903
1900.0	67724.3	1469.1	-11.946	78.223	-1.884	-.080	9.424	1.536	173.300
1902.0	67115.6	1451.9	-12.177	78.218	-3.402	-.125	9.302	1.519	174.699
1904.0	66502.9	1434.9	-12.401	78.182	-3.481	-.236	9.118	1.503	176.165
1906.0	65887.0	1417.2	-12.606	78.124	-1.309	-.036	8.904	1.485	177.333
1908.0	65268.7	1398.4	-12.847	77.947	-1.380	.042	8.708	1.466	178.052
1910.0	64646.9	1379.5	-13.091	77.801	-.571	.226	8.665	1.447	178.733
1912.0	64022.8	1360.2	-13.312	77.701	-1.414	.413	8.476	1.427	179.407
1914.0	63397.2	1338.6	-13.563	77.678	-3.241	.339	8.339	1.408	179.955
1916.0	62770.6	1319.0	-13.784	77.444	-4.419	-.075	8.159	1.389	180.857
1918.0	62143.2	1300.2	-14.012	77.112	-3.916	-.583	7.988	1.371	181.839

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1920.0	61514.2	1281.7	-14.253	76.869	-2.035	-.747	7.973	1.354	182.871
1922.0	60885.0	1263.6	-14.441	76.660	-1.855	-.848	7.900	1.337	183.955
1924.0	60257.2	1245.5	-14.612	76.488	-.469	-.906	7.876	1.319	184.932
1926.0	59632.1	1227.9	-14.730	76.535	2.936	-.311	7.771	1.303	186.011
1928.0	59011.5	1210.7	-14.834	76.668	3.785	.056	7.600	1.286	187.099
1930.0	58395.2	1193.1	-14.948	76.758	2.716	-.562	7.534	1.269	187.951
1932.0	57783.7	1173.6	-15.073	76.943	7.608	.104	7.432	1.248	187.528
1934.0	57176.4	1153.2	-15.246	77.204	7.196	-.095	7.425	1.226	186.416
1936.0	56573.1	1132.7	-15.410	77.542	8.920	.053	7.852	1.203	185.110
1938.0	55980.4	1110.4	-15.310	78.011	9.240	.240	7.710	1.178	182.887
1940.0	55399.2	1087.4	-15.429	78.545	9.699	.530	7.475	1.151	179.930
1942.0	54825.3	1065.4	-15.539	78.866	-.848	.850	7.541	1.126	177.171
1944.0	54259.4	1044.7	-15.638	78.690	-7.035	.680	7.473	1.102	174.657
1946.0	53699.7	1024.4	-15.832	78.231	-9.396	.418	7.284	1.079	172.127
1948.0	53142.2	1005.4	-16.108	77.693	-10.137	.232	7.197	1.058	169.915
1950.0	52585.3	988.0	-16.431	77.112	-10.885	-.199	6.907	1.038	168.277
1952.0	52025.2	971.8	-16.853	76.650	-8.975	-.236	6.919	1.020	167.021
1954.0	51461.1	957.3	-17.218	76.244	-8.067	-.253	6.989	1.004	166.470
1956.0	50894.0	944.4	-17.561	75.887	-6.259	-.322	7.028	.990	166.392
1958.0	50324.0	933.3	-17.873	75.603	-5.406	-.303	6.957	.978	166.839
1960.0	49750.6	923.6	-18.187	75.454	-4.285	.141	7.016	.966	167.513
1962.0	49172.3	916.0	-18.569	75.236	-6.000	.381	6.807	.956	168.876
1964.0	48586.3	911.0	-18.912	74.794	-5.246	.025	6.934	.950	171.562
1966.0	47995.2	907.0	-19.046	74.522	-3.096	.071	7.542	.945	174.662
1968.0	47407.2	902.5	-18.952	74.435	-2.090	.449	7.580	.939	177.489
1970.0	46827.3	896.4	-18.765	74.252	-1.058	.422	7.572	.932	179.718
1972.0	46256.4	889.5	-18.622	74.081	.683	.232	7.446	.924	181.701
1974.0	45693.8	885.3	-18.399	74.163	-1.510	.274	7.479	.919	184.773
1976.0	45142.1	881.7	-18.079	74.093	-2.794	.333	7.129	.915	188.062
1978.0	44598.3	880.8	-18.024	74.087	-2.108	.466	6.263	.913	192.275

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
1980.0	44051.7	879.6	-18.266	74.106	-2.055	.575	5.788	.911	196.496
1982.0	43499.2	871.1	-18.617	73.668	-2.204	.316	5.815	.902	197.530
1984.0	42943.4	863.7	-18.813	73.329	-1.877	.061	5.923	.894	199.389
1986.0	42387.2	858.3	-18.981	73.412	-2.031	.317	5.724	.889	202.670
1988.0	41828.8	854.5	-19.165	73.450	-2.041	.686	5.518	.886	206.687
1990.0	41267.9	851.7	-19.319	73.222	-3.443	.090	5.247	.884	211.239
1992.0	40703.4	848.9	-19.523	73.132	-.547	-.332	5.206	.882	216.519
1994.0	40136.1	844.8	-19.720	73.185	-.217	.522	4.928	.880	221.508
1996.0	39565.9	839.9	-19.933	73.018	-7.604	.701	4.888	.877	226.198
1998.0	38994.4	835.0	-20.065	72.130	-16.200	.682	4.905	.873	230.226
2000.0	38422.0	831.8	-20.251	70.612	-25.457	.005	4.690	.867	233.416
2002.0	37841.8	827.8	-20.828	68.541	-34.637	-.011	4.978	.860	236.360
2004.0	37248.1	822.3	-21.443	65.692	-41.869	.240	5.819	.852	238.628
2006.0	36644.6	814.3	-21.973	62.119	-46.824	.313	6.363	.841	239.177
2008.0	36033.9	805.0	-22.440	57.866	-49.491	.091	7.136	.828	239.028
2010.0	35422.1	795.2	-22.663	52.880	-50.363	-.062	7.536	.815	238.537
2012.0	34813.3	785.6	-22.935	47.769	-50.450	-.080	7.054	.803	237.893
2014.0	34202.3	776.8	-23.276	42.703	-49.481	-.046	7.530	.791	237.572
2016.0	33594.1	765.0	-23.409	37.799	-46.175	.051	7.803	.776	235.317
2018.0	32997.3	753.4	-23.149	32.875	-43.341	.108	7.747	.762	233.205
2020.0	32413.8	745.4	-22.971	28.602	-41.413	.137	7.509	.752	233.536
2022.0	31841.7	738.1	-22.782	24.286	-42.786	.215	7.144	.743	233.907
2024.0	31276.2	731.8	-22.733	19.807	-42.593	-.096	7.119	.735	234.721
2026.0	30718.7	726.4	-22.527	15.487	-40.974	-.259	7.160	.727	235.627
2028.0	30171.6	720.8	-22.282	11.213	-40.851	-.193	7.050	.719	236.245
2030.0	29635.3	712.9	-21.981	6.787	-41.963	-.244	7.196	.708	234.574
2032.0	29108.9	705.9	-21.956	2.401	-43.787	-.074	7.292	.698	233.374
2034.0	28588.2	698.5	-21.921	-2.476	-44.569	.095	7.734	.689	232.476
2036.0	28074.7	690.9	-21.794	-7.519	-41.690	-.016	7.634	.680	231.309
2038.0	27571.9	686.2	-21.366	-12.058	-40.319	-.148	7.540	.673	231.902

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
2040.0	27082.0	680.5	-20.944	-16.605	-39.482	-.114	7.688	.666	231.708
2042.0	26607.1	675.5	-20.413	-20.990	-36.141	-.065	7.434	.659	231.692
2044.0	26149.8	669.4	-19.639	-25.267	-36.402	-.109	7.552	.651	230.820
2046.0	25711.7	661.8	-19.045	-29.594	-34.195	-.281	7.495	.643	228.771
2048.0	25293.7	654.3	-18.344	-33.678	-32.317	-.439	7.189	.634	226.548
2050.0	24892.6	647.7	-17.880	-37.328	-30.607	-.395	6.890	.626	224.826
2052.0	24501.5	642.4	-17.716	-40.920	-31.417	-.445	6.893	.620	223.905
2054.0	24115.2	638.3	-17.698	-44.541	-32.353	-.306	7.046	.615	223.777
2056.0	23731.9	635.2	-17.492	-48.459	-33.359	-.226	7.583	.610	224.361
2058.0	23357.2	631.9	-17.151	-52.719	-34.980	-.400	7.685	.606	224.675
2060.0	22992.5	628.5	-16.637	-57.273	-35.927	-.582	7.678	.602	224.869
2062.0	22638.3	625.5	-16.455	-61.546	-37.152	-.750	7.481	.598	225.324
2064.0	22289.9	622.6	-16.022	-65.677	-32.780	-.668	7.910	.595	225.886
2066.0	21956.3	619.3	-15.308	-69.596	-32.566	-.452	7.898	.591	225.931
2068.0	21636.6	616.0	-14.844	-73.587	-31.918	-.343	7.500	.587	225.808
2070.0	21324.1	613.5	-14.724	-77.278	-32.186	-.376	7.479	.583	226.247
2072.0	21015.9	610.7	-14.487	-81.131	-32.126	-.395	7.514	.580	226.343
2074.0	20713.3	608.3	-14.383	-84.926	-32.855	-.488	7.021	.577	226.753
2076.0	20408.5	607.0	-14.672	-88.641	-34.470	-.464	7.068	.575	227.955
2078.0	20099.4	605.9	-14.927	-92.601	-35.722	-.430	6.694	.573	229.314
2080.0	19780.8	605.5	-15.518	-96.598	-36.982	-.387	6.818	.572	231.341
2082.0	19452.4	605.3	-16.009	-100.875	-38.457	-.298	6.481	.571	233.709
2084.0	19109.8	605.8	-16.672	-105.255	-39.986	-.183	6.887	.571	236.674
2086.0	18753.5	607.9	-17.372	-109.852	-42.643	-.042	7.174	.572	241.023
2088.0	18383.4	610.0	-17.920	-114.947	-43.809	.153	7.132	.573	245.549
2090.0	18000.9	612.0	-18.261	-120.315	-43.911	.164	7.409	.574	250.171
2092.0	17611.4	613.5	-18.627	-125.669	-44.042	.209	7.359	.575	254.533
2094.0	17217.5	613.9	-18.619	-131.182	-41.930	.211	7.047	.574	258.157
2096.0	16822.8	614.1	-18.486	-136.458	-39.973	.112	6.834	.574	261.603
2098.0	16430.5	614.5	-18.547	-141.248	-38.401	-.035	6.324	.573	265.143

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
2100.0	16036.6	614.4	-18.508	-145.787	-36.522	-.012	6.175	.572	268.223
2102.0	15642.9	612.9	-18.603	-150.091	-36.542	-.034	6.066	.569	269.928
2104.0	15249.5	610.2	-18.558	-154.379	-33.104	.012	5.741	.566	270.546
2106.0	14857.5	607.5	-18.732	-158.012	-30.935	-.057	5.346	.562	271.256
2108.0	14462.6	605.2	-18.888	-161.430	-29.381	-.006	5.436	.559	272.397
2110.0	14067.7	603.3	-18.842	-164.717	-25.772	.029	5.486	.557	273.923
2112.0	13677.2	603.7	-18.559	-167.525	-18.997	-.029	5.003	.556	277.903
2114.0	13291.7	603.9	-18.259	-169.428	-11.608	-.000	4.730	.556	281.695
2116.0	12910.6	605.9	-18.232	-170.677	-5.736	-.205	4.182	.557	287.146
2118.0	12525.6	607.1	-18.426	-171.002	.084	-.162	4.191	.558	292.515
2120.0	12136.6	608.6	-18.522	-171.246	.520	-.284	3.940	.559	297.605
2122.0	11744.5	605.7	-18.787	-171.406	.682	-.270	3.880	.555	298.236
2124.0	11355.7	595.6	-18.574	-171.548	.617	-.128	3.716	.545	291.627
2126.0	10972.7	585.4	-19.016	-171.836	-1.137	-.137	3.318	.535	284.839
2128.0	10582.1	581.3	-19.595	-172.242	-.910	-.183	3.740	.530	284.071
2130.0	10183.3	578.8	-20.313	-172.357	1.054	-.093	3.712	.527	284.841
2132.0	9778.0	575.4	-20.328	-172.490	-1.199	-.021	4.139	.523	284.892
2134.0	9378.7	570.3	-20.143	-172.586	-1.310	-.108	4.081	.518	283.245
2136.0	8985.7	565.5	-19.967	-172.528	1.027	-.023	4.277	.513	281.861
2138.0	8600.1	562.8	-19.677	-172.201	1.630	-.194	4.302	.509	282.333
2140.0	8221.7	559.1	-19.315	-171.911	.901	.093	4.384	.505	281.718
2142.0	7854.3	553.6	-18.875	-171.795	-.225	-.102	4.281	.500	279.279
2144.0	7496.4	547.0	-18.752	-171.642	.838	-.213	4.370	.493	275.467
2146.0	7143.1	541.7	-18.772	-171.428	1.334	-.451	4.584	.488	272.911
2148.0	6793.8	536.6	-18.735	-171.073	1.124	-.221	4.554	.483	270.578
2150.0	6446.3	532.3	-18.819	-171.389	-.735	-.349	4.724	.478	268.703
2152.0	6098.5	528.9	-19.146	-171.771	-.092	-.236	4.764	.474	267.804
2154.0	5748.2	528.5	-19.147	-171.686	1.126	.055	4.790	.473	270.036
2156.0	5397.8	531.4	-19.038	-171.534	-2.002	.030	4.720	.475	275.907
2158.0	5048.7	532.9	-18.906	-171.687	-2.338	-.183	4.408	.476	280.309

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
2160.0	4699.5	531.0	-19.098	-171.386	.044	-.044	4.420	.474	281.801
2162.0	4346.6	530.2	-19.331	-170.606	2.326	.706	4.809	.474	284.893
2164.0	3991.4	531.2	-19.527	-169.945	-.323	1.251	4.761	.475	289.983
2166.0	3633.3	538.8	-18.815	-170.520	-2.144	.468	5.553	.483	303.446
2168.0	3296.5	546.4	-16.852	-170.881	1.048	-.494	6.005	.491	317.395
2170.0	2998.9	549.7	-14.438	-170.305	3.846	-.239	5.658	.495	326.102
2172.0	2744.7	546.7	-11.804	-169.448	2.733	.715	6.100	.493	327.188
2174.0	2545.1	537.7	-8.960	-169.151	-.256	.872	6.263	.487	320.512
2176.0	2400.9	525.8	-6.218	-169.562	-1.022	.240	6.137	.477	309.264
2178.0	2300.7	512.7	-4.672	-169.486	.143	.363	5.984	.466	296.041
2180.0	2232.3	494.5	-2.716	-169.333	1.920	.806	6.325	.449	276.146
2182.0	2193.4	475.1	-1.733	-169.078	1.464	.866	5.954	.432	254.956
2184.0	2166.2	456.6	-1.433	-168.739	.056	1.035	5.942	.415	235.475
2186.0	2140.9	439.4	-1.404	-168.741	-3.542	1.288	6.547	.399	218.038
2188.0	2119.8	422.8	-.886	-169.205	-2.095	1.729	7.174	.384	201.885
2190.0	2112.3	406.1	.004	-169.523	-1.109	1.600	6.538	.369	186.287
2192.0	2109.2	391.0	-.157	-169.787	-.547	1.470	6.574	.355	172.670
2194.0	2106.5	376.6	.042	-169.887	.311	1.390	6.398	.342	160.188
2196.0	2104.7	362.4	.169	-169.906	.003	1.364	5.941	.329	148.301
2198.0	2104.8	348.8	.310	-169.941	-.049	.721	5.169	.317	137.400
2200.0	2105.8	335.9	.171	-169.480	-.913	.066	5.561	.305	127.390
2202.0	2105.8	322.9	.170	-168.977	-.242	.640	5.422	.293	117.771
2204.0	2105.7	309.4	.182	-168.832	.068	.674	5.211	.281	108.137
2206.0	2105.8	296.2	.193	-168.637	.382	1.381	4.938	.269	99.077
2208.0	2105.5	282.0	.121	-169.177	.371	1.257	3.494	.256	89.830
2210.0	2105.0	265.8	.105	-168.980	.032	.855	1.519	.241	79.787
2212.0	2104.5	242.5	.226	-168.991	.264	1.084	-2.038	.220	66.394
2214.0	2103.9	219.6	.418	-168.975	.256	1.047	-3.551	.200	54.479
2216.0	2104.3	205.4	.188	-169.024	.472	2.161	-3.662	.187	47.669
2218.0	2104.1	192.2	.120	-170.256	.373	1.571	-3.648	.175	41.715

TIME (SEC)	ALTDE (FT)	VELA (FPS)	GAMA (DEG)	HDGA (DEG)	SIGMAA (DEG)	BETAA (DEG)	ALPHAA (DEG)	MACHA (-)	QA (PSF)
2220.0	2104.0	177.5	.264	-170.078	.119	.820	-3.889	.161	35.596
2222.0	2104.2	158.8	.178	-170.113	.170	1.055	-3.734	.144	28.489
2224.0	2104.1	140.3	.220	-169.599	.097	.447	-3.859	.127	22.236
2226.0	2104.3	123.0	.190	-168.993	.177	1.248	-3.823	.112	17.072
2228.0	2104.4	106.9	.185	-168.637	.038	1.073	-3.877	.097	12.897
2230.0	2104.5	91.2	.224	-168.353	.142	1.659	-3.938	.083	9.385
2232.0	2104.5	75.9	.162	-167.249	.076	1.503	-3.872	.069	6.509
2234.0	2104.7	61.1	.290	-166.874	.168	2.398	-3.997	.056	4.218
2236.0	2104.7	47.6	.131	-166.744	.144	2.934	-3.822	.043	2.563
2238.0	2104.6	35.6	.113	-166.494	.132	3.733	-3.808	.032	1.432
2240.0	2104.7	27.9	.118	-165.189	.136	4.987	-3.772	.025	.879
2242.0	2104.7	21.7	.036	-163.477	.108	6.376	-3.735	.020	.532
2244.0	2104.6	8.6	-.273	-153.444	.038	16.257	-3.467	.008	.083

APPENDIX D

STS-13 Source and Output Products for Archival

D.1 STS-13 Output Products

(a) FILES

NAME	USER CATALOG	DESCRIPTION
BT13M23	169750N	Final reconstructed trajectory (40 word format per AMA 81-1)
ST13BET	274885C	Final extended BET (66 word format per AMA 81-11)
NAVBT13	389102C	STS-11 onboard nav BET (66 word format)
NOAA13	581199C	Final LAIRS file
TRWST13	274885C	Reformatted JSC/TRW BET (66 word format)
IMACP13	274885C	Signal difference file (IMU2-ACIP)

b) TAPES

REEL NO.	DESCRIPTION
NC0728	STS-13 AEROBET (201 words per AMA 82-9)
NC0740	Duplicate of above
NC0760	25 Hz IMU2 GTFILE (62 words per AMA 81-20)
NC0757	25 Hz ACIP GTFILE (62 words per AMA 81-20)
NC0703	25 Hz bias rectified ACIP file for GTFILE generation
NG0162	25 Hz IMU2 body axes @ ACIP (epoch: 46890^{S} GMT)
NX0472	25 Hz edited, "thinned", ACIP data (epoch: 46890^{S} GMT)
NL0507	Final STS-13 residuals for BT13M23
NX0470	Edited tracking tape
NX0683	1 Hz OI-2 for AEROBET
NX0681	20 Hz IMU2 file in body axes for ST13BET, AEROBET, and GTFILE (calibrated per BT13M23 solution)
NL0239	Dynamic data (input for trajectory reconstruction)- 20 Hz IMU2 data in platform coordinates (second CDC record)

D.2 Source Tapes Received via NASA LaRC

(a) T/M TAPES

REEL NO.	DESCRIPTION
NT0370	OI-1
NT0831	OI-2
NT0774	OI-3 (source for RGA1/AA1 data)
NT0752	OI-4
NR1144	OI-1 from CBET1F

(b) ACIP TAPES

REEL NO.	DESCRIPTION
NU0264 NU0266 NU0265 NU0301	ACIP housekeeping
NU0255 NU0257 NU0259 NU0234	150 Hz linear cal ACIP

(c) Tracking Tapes

REEL NO.	DESCRIPTION
NC0911	JSC/TRW tracking data
NU0316	Goddard Space Flight Center data
ST5673	AFFTC theodolite data

(d) Other

REEL NO.	DESCRIPTION
NK0112	JSC/TRW Descent BET
ST5674	Jimsphere data (balloon 1; landing - 5 hours)
ST5675	Jimsphere data (balloon 2; landing - 3 hours)
ST5676	Jimsphere data (balloon 3; landing - $1\frac{1}{2}$ hours)
ST5677	Jimsphere data (balloon 4; landing + 15 minutes)

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15. Supplementary Notes

Langley Technical Monitor: Harold R. Compton

16. Abstract

Results from the STS-13 (41-C) Shuttle entry flight are presented. The entry trajectory was reconstructed from an altitude of 700 kft through rollout on Runway 17 at EAFB. The anchor epoch utilized was April 13, 1984 $13^h1^m30\overset{s}{.}0$ ($46890\overset{s}{.}0$) GMT. The final reconstructed inertial trajectory for this flight is BT13M23 under user catalog 169750N. Trajectory reconstruction and Extended BET development are discussed in Section I and II, respectively. The NOAA "totem-pole" atmosphere extracted from the JSC/TRW BET was adopted in the development of the LaRC Extended BET, namely ST13BET/UN=274885C. The Aerodynamic BET was generated on physical nine track reel NC0728 with a duplicate copy on NC0740 for back-up. Plots of the more relevant parameters from the AEROBET are presented in Section III.

Section IV discusses the MMLE input files created for STS-13. Appendices are attached which present spacecraft and physical constants utilized (Appendix A), residuals by station and data type (Appendix B), a two second spaced listing of trajectory and air data parameters (Appendix C), and input and output source products for archival (Appendix D).

17. Key Words (Suggested by Author(s))	18. Distribution Statement
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